

# Popular Science

FOUNDED MONTHLY 1872

RADIO SECTION  
PAGE 74

*How you can replace  
"B" batteries with  
alternating current.*

*An easy way to add  
a radio-frequency  
amplifier to your set.*



## Amazing plane its own parachute

APRIL

See page 30

25 CENTS



# Music—

Far away in a spacious hall, a great orchestra  
unrolls the rich melody-pattern of a master  
symphony. Far away in a vast cathedral, an  
organ pours forth the theme of an age-old  
hymn. Far away in a world-famed opera  
house, a drama is revealed in song.

Far away—but with a turn of the dial—near!  
Near—vivid—real—with the **Super**  
**Heterodyne**. You are part of the  
a silent, moveless listener to magical



## **Radiola Super-Heterodyne**

The Radiola that brings in far  
stations without ground or an-  
tenna—that gets the station you  
want—gets it always at the same  
marked spot—gets it simply—  
clearly! Its tone is as famous as  
its performance.

*"There's a Radiola for every purse"*

This symbol of quality **RCA** is your protection

**RADIO CORPORATION  
OF AMERICA**  
Sales Offices:

253 Broadway, New York  
10 So. La Salle St., Chicago, Ill.  
28 Geary St., San Francisco, Cal.

# Radiola

REG. U.S. PAT. OFF.

Copyrighted material



# CROSLEY TRIRDYNS

*Special*  
\$60  
*Formerly \$75*



*Regular*  
\$50  
*Formerly \$65*



*Three Tubes  
Do the work of  
Five or Six  
in the  
Trirdyn*

The recognized outstanding achievement in radio is the Crosley Trirdyn. An overwhelming amount of evidence proves that it is excelled by none and superior to most receivers costing many times more. It is a three tube radio combining one stage of tuned radio frequency, regenerative detector and sales amplification. This combination enables three tubes to do the work of five or six. Brings in every large station in the country on the loud speaker. Is very selective, easy to tune and economical to operate.

The straight front Trirdyn Regular, formerly \$65, now \$50. The Trirdyn Special in large cabinet to house dry cell batteries formerly \$75, now \$60. To these have been added the new Trirdyn Regular with sloping panel at \$55 and the new Trirdyn Special in a beautiful cabinet with sloping panel at \$65. Demand a Crosley Trirdyn at any good dealer. All Crosley radios are licensed under Armstrong Regenerative U. S. Patent 1,113,149. Write for catalog.

*Price With of Radio Model 1925*

**THE CROSLEY RADIO CORPORATION**

*Paul Crosley Jr., President*

417 Sassafras Street

Cincinnati, Ohio

*Crosley Green and Orange Broadcasting Station WCLF*





# Popular Science Monthly

Most Wonderfully Illustrated Magazine in the World

APRIL, 1925; Vol. 106, No. 4

25 cents a Copy; \$2.50 a Year



Published in New York City at  
250 Fourth Avenue

## Coming Next Month

**New wonders in store**—Amazing strides in the transmission of pictures by wire and radio during the last year indicate that we are on the threshold of tremendous new discovery. What will it be? Shall we be able to see and talk with distant friends as easily as we now listen to broadcast entertainment? Don't miss this fascinating story of television.

**Commuting by aero-car**—How French inventors plan to relieve congestion of suburban traffic in Paris by an ingenious propeller-driven car speeding 60 miles an hour on rails high above streets and houses.

**Cross country with the air mail**—Thrilling experiences of aerial postmen who, day after day, bridge the distance between New York and San Francisco. An inside story of the world's most remarkable postal system.

**Are you a radio beginner?**—If so, you won't want to miss an article by Alfred P. Lane next month telling how to build a simple but highly efficient one-tube set.

Paul P. Scott, intrepid air-mail pilot, whose recent miraculous escape from death near Salt Lake City will be described next month.



And more than 200 other fascinating articles and pictures, giving you all the news of radio and engineering, science and invention, strange and unusual things people are doing, together with practical ideas for the automobile, the home, the home workshop, and the use of tools and machinery.

## POPULAR SCIENCE MONTHLY

Issued monthly. Single copy, 25 cents. Yearly subscription in United States, its possessions, and Canada, \$2.50; foreign countries, \$3. Entered as second-class matter Dec. 28, 1915, at the Post Office at New York under the act of March 3, 1879. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright, 1925, by the Popular Science Publishing Co., Inc. The contents of this magazine must not be reprinted without permission. In presenting in its editorial columns numerous stories of new products of applied science, POPULAR SCIENCE MONTHLY does not underwrite the business methods of the individuals or concerns producing them. The use of POPULAR SCIENCE MONTHLY articles, or quotations from them for such-selling schemes is never authorized. G. B. Capen, President and Treasurer; R. C. Wilson, Vice-President; A. L. Cole, Secretary.

## In This Issue

|  | Page |
|--|------|
| Popular Science Institute of Standards | 25   |
| The Magic Stuff that Saved Nemo        | 27   |
| By Robert Mott Woodley                 |      |
| Amazing Airplane Its Own Parachute     | 30   |
| By Truman Stevens                      |      |
| Airplanes Hurled to Bits in Test       | 31   |
| By Newton Burke                        |      |
| The Taming of Dynamite                 | 32   |
| By Robert Brackford                    |      |
| Periscope Seen and Heard               | 35   |
| Newest Weapons for Fire Fighters       | 36   |
| Do Your Eyes Tell You Lies?            | 37   |
| By Alan Bennett                        |      |
| Why the Eclipse Was Late               | 39   |
| By Raymond J. Brown                    |      |
| Colds                                  | 40   |
| By Malcolm MacDonald                   |      |
| What Hugs Do to Liners                 | 42   |
| Inventors Who Speed Your Mail          | 43   |
| By Norman C. McClelland                |      |
| New Milestones in Aeronautics          | 46   |
| Weather Man Makes His Own Climate      | 46   |
| Actors Radio Play to Deal              | 48   |
| Where the Big Trees Crash Down         | 49   |
| The Missing Link Found at Last         | 50   |
| Rural Mailbox Stand Revolves           | 52   |
| Pocket Check Protector                 | 52   |
| New Voltage Tester                     | 52   |
| Typewriters Silenced                   | 53   |
| New Typewriter Desk                    | 53   |
| Self-Feeding Typewriter Brush          | 53   |
| Useful and Ingenious Machines          | 54   |
| Electric Hand Saw Has Many Uses        | 56   |
| Handy Pocket Screwdriver               | 56   |
| New Polishing Tool                     | 56   |
| Railway Ties Dated with Brand          | 57   |
| Rack Keeps Paint Brushes Pliable       | 57   |
| One Man Pulls Railway Car              | 57   |
| Monorail Subway Planned in England     | 58   |
| Odd Ferry Driven by Tractors           | 58   |
| Niagara to Be Illuminated              | 59   |
| P. S. to Link Coastal Waterways        | 59   |
| Interesting Giants and Minors          | 60   |
| Toolbox Forms Convenient Flip          | 62   |
| Compressed-Air Pistol Cleaner          | 62   |
| New Blasting Machine                   | 62   |
| Care for Business or Pleasure          | 63   |
| Flexible Traffic Post                  | 63   |
| Dressing Rooms for Taxi Drivers        | 64   |
| Brush for Cleaning Carpet Sweeper      | 64   |
| New Blower Cleans Machinery            | 64   |
| Collapseable Canoe                     | 65   |
| Handy Flour Waker                      | 65   |
| Mechanical Belt Lacer                  | 65   |
| Stencil Makes Bow Lips                 | 66   |
| Pocket Clear Piercer                   | 66   |
| Self-Sharpening Shaving Brush          | 66   |
| Ferns Water Themselves                 | 67   |
| Reflector Serves as Stove              | 67   |
| A Sprinkler Porch Swing                | 67   |
| Home Chlorine Treatment for Colds      | 68   |
| Fresh Air Telephone Booths             | 68   |
| Machione Predicts Tire Life            | 68   |
| Unique Lifeboat Rides Heavy Seas       | 69   |
| Illuminated Sign Post                  | 69   |
| A Dry-Land Houseboat                   | 69   |
| Handy Kit for Baby's Bottle            | 70   |
| Pocket Picture Projector               | 70   |
| Telephone Magnifying Glass             | 70   |
| Portable Electric Heater               | 71   |
| Burglar-Proof Safe for Churches        | 71   |
| New Sander for Dentists                | 71   |
| Science Aids the Modern Housewife      | 72   |
| A Radio-Frequency Amplifier            | 74   |
| By Alfred P. Lane                      |      |
| Alternating Current for B Batteries    | 76   |
| By Alexander Semak, M. E.              |      |
| The Month's Novel Radio Ideas          | 77   |
| How to Select Your Loudspeaker         | 78   |
| By Arthur A. Stuart                    |      |
| What Does "Low Low" Mean?              | 79   |
| By John Carr                           |      |
| How Quickly Can You Stop Your Car?     | 80   |
| By Robert E. Marica                    |      |
| Shortcuts for Car Owners               | 82   |

The Home Workshop..... 83

Better Shop Methods..... 88

And other timely articles and pictures



**\$12,000 a Year!**A. H. Ward,  
Chicago, Ill.

A. H. Ward, Chicago, held a small pay job. Now he averages \$12,000 a year as a salesman. Last month he cleaned up \$1,350 and he stepped into this kind of earnings as a result of reading this book.



# What This Amazing Book Did for These 8 Men

It would be just as easy to tell the same story about thousands of men—but what this book brought these eight men is typical. If you do not get a big salary increase after reading this message you have no one but yourself to blame. This amazing book is

**\$1,000 in 30 Days**

"After ten years in the railway mail service I decided to make a change. My earnings during the past thirty days were more than \$1,000."

W. Hartle,  
Chicago, Illinois.

**First Month \$1,000**

"The very first month I earned \$1,000. I was formerly a farm-hand."

Charles Berry,  
Winterset, Iowa.

**\$524 in 2 Weeks**

"I have never earned more than \$60 a month. Last week I cleared \$306 and this week \$218."

Geo. W. Kearns,  
Oklahoma City.

**City Salesman**

"I want to tell you that the N. S. T. A. helped me to a good selling position with the Shaw-Walker Company."

Wm. W. Johnstone, Jr.,  
S. Minneapolis, Minn.

**\$554.37 in One Week**

"Last week my earnings amounted to \$554.37; this week will go over \$400."

P. Wynn,  
Portland, Ore.

**\$100 a Week in Only 3 Months**

H. D. Miller, of Chicago, made \$100 a month as stenographer in July. In September, 3 months later, he was making \$100 a week as a salesman.

**\$10,000 a Year**

O. H. Malfroot, of Boston, Mass., stepped into a \$10,000 position as a SALES MANAGER—so thorough is this training.

## NOW FREE

It seems such a simple thing—but the eight men on this page who did this simple thing were shown the way to quickly jump from dead, monotonous routine work and miserable earnings to incomes running anywhere from \$5,000.00 to \$10,000.00 a year.

### They Sent for the Book, "Modern Salesmanship," That You Can Now Get—Free

Possibly it is just as hard for you at this moment to see quick success ahead as it was for A. H. Ward of Chicago. When he was a soldier in France, wondering how he would make a living if he got back home safely, \$10,000 a year seemed a million miles away. But read what happened after he had read the book we want you to send for. Almost overnight, as far as time is concerned, he was making real money. The first year he made \$10,000.00.

There is nothing unusual about Mr. Ward, or about his success. Thousands after reading this book have duplicated what he did—Mr. Ward simply was willing to investigate.

The only question is—do you want to increase your earning power? If so—this book will quickly show you how to do it in an amazingly easy way.

### Success Inside Twenty Weeks

There is no long, drawn-out wait after you have sent for this book before you begin to do as the men on this page did. Within twenty weeks you can be ready to forge ahead. This may sound remarkable—but after seventeen years of intensive investigation the National Demonstration Method has been perfected—and this means you can now step into a selling position in one-fourth the time it formerly took to prepare for this greatest of all money-making professions.

Men in every walk of life have made this change—farmers, mechanics, bookkeepers, ministers—and even physicians and lawyers have found that Salesmanship paid such large rewards and could be learned so quickly by this new method that they preferred

to ignore the years they spent in reading law and studying medicine and have become Master Salesmen.

### Simple as A B C

There is nothing remarkable about the success that men enjoy shortly after they take up this result-securing system of Salesmanship training. For there are certain ways to approach different types of prospects, certain ways to stimulate keen interest—certain ways to overcome objections, batter down prejudice, outwit competition and make the prospect act. Learn these secrets and brilliant success awaits you in the selling field.

### Make This Free Test At Once

You don't need experience or a college education. And if you are not sure of yourself, you can find out at once whether you can make big money as a Star Salesman. Simply send the coupon for this Free Book. Ask yourself the questions it contains. The answers you make will show you definitely whether a big success awaits you in this fascinating field. Then the road is clear before you. This amazing book will be a revelation to you. Send for it at once while this free offer is open.

### NATIONAL SALESMEN'S TRAINING ASSOCIATION

Dept. 15-D

N. S. T. A. Building, CHICAGO, ILL.



National Salesmen's Training Ass'n,  
Dept. 15-D,  
N. S. T. A. Building,  
Chicago, Ill.

Gentlemen: I will accept a copy of "Modern Salesmanship" with the understanding that it is sent me entirely free.

Name.....

Address.....

City..... State.....

Age..... Occupation.....



Tom Plumridge, 34 years in the Auto business, is the master of Expert Automotive Maintenance. He has owned 100 cars, 50000 P.A.S. cars, and 100000. He has 100000 cars in the way. He has trained more Auto experts than any other man alive.



**GO TO  
AUTO  
SCHOOL  
AT HOME**

Directing  
Auto Engineer  
Plumridge

**I Guarantee  
you a  
50%  
Raise!**

**Look  
Here!**

Build a business of  
your own like this!

**Read  
my  
Guarantee**

If you are now making less than \$40 a week **ENROLL** for my home auto-training and I **GUARANTEE YOU** within sixty days after you finish, a position at 50% more pay or I will refund every cent of your money.

after you finish  
my training

spare time to run or OWN a great "Up-Keep" service station like this. Not as mechanic, but as **EXPERT!** Not doing the jobs, but knowing how and bossing them!

**Start at \$60**

**Climb to \$200 a Week!**

They only make 3 million new cars a year, but there are 16 million autos, trucks, buses, taxis, and tractors to **KEEP GOING!** "Up-Keep" is the big end, the **BIG MONEY** end of the auto business. Look at the picture! My training prepares you **AT HOME** in spare time to run or OWN a great "Up-Keep" service station like this. Not as mechanic, but as **EXPERT!** Not doing the jobs, but knowing how and bossing them!



**Has Own Garage**

Clifford J. Coon, Southville, Ohio, opened his own garage, and reports tremendous profitable business.



**Salary Doubled**

E. R. Owens, Marion, Va., only finished the sixth grade in school. My training doubled his salary in five months.



**Owens Business**

Carl F. Hieb, Madison, Wis., was prosperous Auto-Expert before. Now he knows how to keep his garage.

Millions of auto owners, corporations with truck or freight-transport fleets, won't put up with the blundering "practical experience" mechanic when they can get instant, guaranteed, trained service from an **EXPERT!** This idea of Expert "maintenance" service is **NEW**—it's growing—it is becoming a **5 BILLION DOLLAR A YEAR** industry. That's the kind of business to go into, where there's almost **NO LIMIT** to the money you can make, where there are thousands of big-pay jobs waiting for Experts, and hundreds of opportunities to go into business with little capital. Common schooling all you need.

**This is my idea of an Auto Expert:**

Yes, you've got to know all about the mechanical and electrical "up-keep" of autos, but you must know more to go after the **BIG MONEY**. You must know the business end, most of all. And so I train you in Garage management, Automotive Advertising and Selling, Shop Practice, how to get business and take care of it, how to build goodwill, etc. **AMERICAN SCHOOL** has been noted for business home-training for 28 years. You can't get better anywhere else. So you see I'm not talking about a mechanic's job at \$30 a week. My training makes you an all-round **EXPERT**—the Expert who owns or manages the whole business, who bosses the mechanics, the Expert who **KAOPS** autos, trucks, buses, taxis, tractors like A. B. C.

**Let's talk this over!**

Look into this opportunity. What I tell you here is only a small part. The rest is in my 36-page book **THE WAY TO BIGGER PAY**. Find out **ALL** about the "Up-keep" end of the Auto business. Find out **ALL** about my "JOB-METHOD" home-training. Find out what my 50% raise guarantee means to you in dollars and cents. Find out what a fascinating, **BIG MONEY** opportunity Auto "Maintenance" offers. **Coupon Brings My Complete Offer—mail it today!**

**Raises, Extra Money for STUDENTS**

My "JOB-METHOD" combines home-training, actual experience, and money-making in a new way. Students engaged in auto work only part way thru my course report frequent raises. Others say they earn as much in an evening as a whole month's 100-hour work. So don't be lousy of money (or anything else) keep you from getting my training. Yes, too, can make this training pay for itself, and then some!

Here is your Coupon!

**I WANT TO BE  
AN AUTO EXPERT**

**TOM PLUMRIDGE, Directing Auto Engineer**  
AMERICAN SCHOOL, Dept. A-475,  
Drexel Ave. and 50th St., CHICAGO

Send me **QUICK** please, your 36-page book **THE WAY TO BIGGER PAY** and complete information about the "up-keep" end of the Auto business, about your "JOB-METHOD" home-training, and about your 50% raise guarantee.

Name.....  
St. No.....  
City.....  
State.....

**TOM PLUMRIDGE, Directing Auto Engineer,**  
**AMERICAN SCHOOL, Dept. A-475, Drexel Ave.**  
**and 50th St., CHICAGO**



**\$500<sup>00</sup> in one  
Month  
for Drawing**

Careful, conscientious training by members of our faculty made this possible. To-day, trained illustrators who draw pictures for magazines, newspapers, etc., both men and women—

**Earn \$200 to \$500 a month  
and more**

The present splendid opportunities in this field have never been equalled. Thousands of publishers buy millions of dollars' worth of illustrations every year. Illustrating is the highest type of art. If you like to draw, let your talent make your fortune. Develop it. It takes practice, but so does anything worth while. Learning to illustrate is fascinating to anyone who likes to draw.

**The Federal Course is a proven Result Getter  
THE FEDERAL AUTHORS**

include such nationally known artists as Sid Smith, Neysa McMein, Fontaine Fox, Charles Livingston Bull, Clare Briggs and over fifty others. Exclusive, original lessons especially prepared by these famous artists are included in the Federal Home Study Course.

**SEND TODAY FOR  
"A ROAD TO BIGGER THINGS"**

Every young man and woman with a liking for drawing should read this free book before deciding on their life's work. It is illustrated and tells all about illustrating as a profession and about the famous artists who have helped build the Federal Course. It also shows remarkable work by Federal students. Just write your name, age, occupation and address on the margin, mail it to us with six cents in stamps, and we will send you a copy of the book free. Do it right now, while you're thinking about it.

**Federal  
School  
of Illustrating**

414 Federal School Bldg. Minneapolis, Minn.

**Wrestling Book FREE**

Learn to be an expert wrestler. Know scientific wrestling, self-defense, and jiu-jitsu. Develop a splendid physique, and have perfect health. Sell this popular illustrated book by mail. The famous world's champion—the marvelous **Frank Gotch and Farmer Herman** offer you a wonderful opportunity. Wrestling is easy and quickly learned at home by mail. Men and boys everywhere have splendid free books. Learn all the science and tricks. Be able to handle big men with ease. Accept this wonderful offer **NOW**. Send for free book today, starting your own. **Former Barn School of Wrestling, 1711 Range Bldg., Omaha, Neb.**

**Stop Forgetting**

Make Your Mind as Solid as Iron. Develop a splendid physique, and have perfect health. Sell this popular illustrated book by mail. The famous world's champion—the marvelous **Frank Gotch and Farmer Herman** offer you a wonderful opportunity. Wrestling is easy and quickly learned at home by mail. Men and boys everywhere have splendid free books. Learn all the science and tricks. Be able to handle big men with ease. Accept this wonderful offer **NOW**. Send for free book today, starting your own. **Former Barn School of Wrestling, 1711 Range Bldg., Omaha, Neb.**

**PROF HENRY DICKSON**  
Dept. 925, Evanston, Ill.



# Do You Want to Make Big Money?

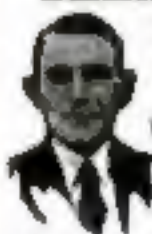


## \$3500 to \$100000 a Year is Easy to Earn in ELECTRICITY!!

**Be a  
Cooke Trained  
Electrical  
Expert**

### READ the Proof from My Students

#### \$30 to \$50 a Day in Business for Himself



J. R. Morgan, 34 Prescott St., Columbus, O., formerly a \$4.00 a day mechanic, now averages over \$40 a day doing electrical work on his own hook.

#### Earns \$800 in 23 Days

Earl R. Montrose, Mono Lake, Calif., gets electrical contract, completes it in 23 days and collects \$800 profit.



#### \$7,000 a Year From Electricity on the Farm



Herbert Dickerson used to earn \$10 a week. Now superintendent of Electrical equipment at North Wales Farm, Warrenton, Va., at \$7,000 a year.

#### Makes \$750 in Spare Time

Before completing course, John J. Burke, 3332 East Baltimore St., Baltimore, Md., made \$750 doing odd electrical jobs in spare time. Now runs his own big business.



**These are Just a Few  
of Hundreds!**

Hundreds of my students are earning this big money holding down big electrical jobs and in business for themselves. You can do it, too. My 16 big guarantees of satisfaction guarantee your success. Never before was there such a demand for electricity and so many trained men to handle it as there is now. \$75 a week is just an ordinary salary. \$100 a week and even \$200 is easy when you are properly trained—trained as I will train you right in your own home. Step out of your small-pay, no-future job. Be a "Cooke" Trained Electrical Expert, for "Cooke" Trained men get the big jobs in Electricity.

### Big Jobs Open to You

In Radio Work, Power Plants, Contracting, Automotive Electricity—everywhere. The biggest jobs are open to "Cooke" trained men. My employment bureau sees to that. I am actually spending over \$25,000 a year just to get jobs for my students.

### I Can Train You Better

Being a college trained engineer with 25 years of practical experience, and now Chief Engineer of the great Chicago Engineering Works, a Million Dollar Institution, I know exactly what kind of training you need to succeed in this big profession. That's what I give you—practical training by a practical man—the kind of training big electrical companies are looking for and are willing to pay for—the kind of training you will need to be successful in business for yourself.

### Start Earning Money at Once

You can turn my training into money quickly—begin with your seventh lesson. I give you FREE a whole outfit of tools and electrical apparatus and show you how to get and how to do spare time jobs. You make several times the monthly payments for my Course, and get real, valuable, practical experience. "Cooke" training pays its own way.

### My 16 Big Guarantees

I give you 16 definite guarantees when you enroll for my Course, including a signed bond to return every penny you pay me if you are not satisfied. These guarantees cover FREE Consultation and Employment Service, FREE tools, FREE use of laboratory, FREE Engineering Magazine and other things previously unheard of in home study training. I spare no expense to make you a big and quick success.

### Use My Money to Go Into Business for Yourself

Every month I start two of my students in business for themselves. I give them all the money they need, help them get started and help them to a big success. Get the details of this great offer from my big FREE book.

### Investigate — Get Proof — Big Electrical Book FREE!

You want proof? You want facts? These I give you in my big book—**The Vital Facts About Electricity**—proof that opportunities more wonderful than you ever dreamed of await you—proof that "Cooke" Trained Men do get the big jobs in Electricity and that I can do more for you than anyone else. Send for my new book now. Be a "Cooke" Trained Electrical Expert—Earn \$70 to \$100 a week. Mail the coupon NOW!

### Part of Big Free Outfit



**Mail  
this  
Coupon  
for my  
FREE  
BOOK**

L. L. COOKE, Chief  
Engineer, Chicago  
Engineering Works,  
Dept. 34

2150 Lawrence Avenue,  
Chicago, U. S. A.

Send me your book, "The Vital Facts About Electricity," full particulars of your Home Study Course, and your station arrangement, including your plan for getting students in business. You don't get students in business for your course.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

**L. L. COOKE, Chief Engineer  
Chicago Engineering Works  
Dept. 34, 2150 Lawrence Ave., Chicago**

**The "COOKE" Trained Man is the "Big Pay" Man!**





## How I Earn \$100.00 a Week as a Radio Expert

**A** YEAR ago I was mightily blue and discouraged. It seemed to me that I would never be more than a low-paid bank clerk. Of course I had a small increase in salary every now and then, but I knew that pretty soon I would reach my limit and there would be no further advancement for me. What future had I to look forward to? Where would I be in five years? I became restless and discouraged and began to look around for some other opportunities.

It was then that I discovered that the demand is for **trained** men, that the opportunities are all for men who can do some one thing better than anything else. There were wonderful opportunities for men who were experts or specialists—but I was ..... a clerk. How I regretted then that I hadn't prepared myself for some definite career!

### I Wanted to Marry

The thing that made me more restless at that time than anything else was the fact that Marian and I were—that is we wanted to be married. But we both knew that we couldn't possibly get along on my salary. If only there was something I could do that would bring me a larger salary!

It was just about the time that every one became so interested in radio. Our whole town became radio-mad, and of course what was happening in our town was happening all over the country—all over the world. I managed to save up enough to buy a receiving set and I was never quite so happy as when I was trying to tune in on stations.

The thing fascinated me. Playing with air waves! Bringing melodies and messages out of the sky! I was never so interested in anything before.

Marian was the first to sense the great opportunity: "Why don't you become a radio expert?" she said. "You like it, and I am sure there must be a big demand for men who understand it. It's a new field and there's plenty of room for wide-awake men."

"But—but I'm not trained!" The thought excited me. To be a radio expert! To find my future in this fascinating new field! "I don't know anything about it, Marian," I said. "I wish I did, though."

"Well, why don't you find out about it?" she retorted. "You can't learn about radio just by listening in to the concerts. Why don't you take a course?"

But we found out that most courses were expensive or that they would interfere with my other work. We were about discouraged

when I discovered that through the National Radio Institute it is possible to become a radio expert by studying right at home in spare time. I told Marian about it and she was elated. "Send off for information at once—today!" she exclaimed.

### Advances Quickly to \$100 a Week

I did, and the following day received an attractive booklet, "Rich Rewards in Radio" telling all about radio opportunities and how to become an expert in any particular phase of the work.

Here was my opportunity at last!

I began to study in all my spare time. It was the most interesting and absorbing study I had ever made. The secret of the radio revealed to me! Day by day I became more skilled and deft until I was able to take apart receiving sets and put them together again as though I were playing with a toy. It was fun! In a month I was able to take a position as linesman at a bigger salary than I was getting at the bank. This was wonderful experience for me, and I kept right on with my studies. It wasn't long before I qualified for a position as radio engineer at a salary of \$100.00 a week! That is what I am earning now, though I expect to make more soon. It seems to me almost too good to be true, after all those years as a low-paid clerk in a bank. And Marian, who will soon be my bride, keeps saying, "I told you so!"

As a radio expert I can tell you that there is a tremendous demand for men who can build, sell and install radio sets, who can design, test, repair. Men are needed as operators, engineers and executives, all over the world. The opportunities are limitless, and if you like radio there is no reason why you cannot qualify for one of these positions by studying in your spare time at home as I did.

The National Radio Institute offers an absolutely complete course which prepares you for the Government First Class Commercial License and for the bigger-paying jobs in Radio. The Director, E. R. Haas, will be glad to send you all details of their marvelous new method of practical instruction, including information concerning the Free Employment Service which secures positions for National Radio Institute graduates. Everyone interested should have this information. It's free, and this coupon will bring it to you. I advise you to send it off today. Radio is a new and interesting field, and it offers you more money than you probably ever dreamed possible.

### Important

Those who mail the coupon at once will also receive details of Special Short Time Reduced Rate. Do it now.

National Radio Institute, Dept. 12-FB,  
Washington, D. C.

I am interested in radio and would like to find out whether or not I am suited for a radio career. Please send me, without the slightest obligation, your interesting free book called "Rich Rewards in Radio." Also full details concerning your special Short Time offer.

Name.....

Address.....

City..... State.....

## FREE Vocational Test

Chicago Technical College  
Dept. 431 118 East 26th Street, Chicago, Ill.  
Gentlemen: Send me, without cost or obligation,  
your Free Vocational Test Lesson and your 40-  
page Booklet of Facts About Drafting.

Name.....  
Address.....  
City..... State.....

Offered  
by a famous

## College of Engineering

Here is an opportunity to prove your fitness and liking for one of Industry's highest-paid professions. Vocational guidance of the highest order—a free test lesson in Drafting.

## DRAFTING

### Short HOME STUDY Course

A Free Trial Home Study Lesson sent you without obligation. Before you enroll we want you to know what drafting is like... how we teach by mail... and whether you will like this fascinating, well-paid profession.

### 40-page Book of Facts, FREE

Tells you all about drafting and our short, intensive drafting courses. What prominent men say... where draftsmen are employed... their salaries... their opportunities... how... and why... many of our students have increased their salaries even before finishing their courses.



Chicago Technical College, founded in 1904, is "America's Oldest and Largest School of Specialized Engineering." It offers to resident students 2-year and 3-year courses in Architecture and Engineering, leading to diplomas and B.S. degrees. Short courses, also, in Drafting, Plan Reading, Estimating, Building Construction, etc. Over 1000 men enrolled each year in day and evening classes. 50% of them accept part-time positions before graduation. 90% of them get positions immediately upon graduation.

### Opportunities in Chicago to Earn while you Learn

For those who can come to Chicago, there is a splendid opportunity to learn Drafting, Engineering or Architecture at the College while earning expenses in part-time positions. If interested, write for 52-page Blue Book of Realism Courses.

### \$35 to \$100 per Week

Everything today... from skyscrapers to turbine engines... is built from drawings made by draftsmen. The American Bridge Co. alone employs 600 to 700 draftsmen. The draftsman works hand in hand with the engineer, the architect, the builder. The better-trained men rise quickly from positions paying \$15 to \$50 per week to \$100, \$400 and \$500 per month and more.

We have been teaching Drafting for 21 years. Thousands of our graduates are in high salary positions, today. We train you in 10 months or less. No special preparation or talent required.

Tuition low; payments easy. Professional outfit included, or credit will be allowed if you have instruments.

### Mail Coupon Now

Today, find out what Drafting may mean to you in your life work. We have made the test easy, for, with no obligation, we send you a Vocational Test Lesson free. Clip coupon at the top of this ad. Mail now.

Chicago **TECHNICAL** College  
Dept. 431, 118 East 26th Street, Chicago



## Prizes for Boys & Girls

Send fifteen cents for the fascinating, entertaining, **GRANDDAD** prize-winning

### CROSS-WORD Puzzle Book

and how to win Red Enjan bicycles, radio sets, wrist watches, cameras, rifles, rings, fountain pens, skates, knives and many other big prizes.

Each contains 1 of our Chicago Chicago Daily News contest prize-winning puzzles and many others.

**LANGDON SPECIALTIES CO.**  
Department F SAINT PAUL, MINN.



# LEARN ELECTRICITY

In Twelve  
Weeks

Not by Correspondence  
All PRACTICAL Work at

**COYNE**

## In Great Shops!

Coyne trained Electrical Experts are in demand everywhere—because they are men who are *practically* trained and *thoroughly* trained for the Big Jobs in Electricity. Send that coupon to me now and see how I fit you for one of the thousands of BIG PAY OPPORTUNITIES in 12 short weeks! No obligation at all! Act quick!

### Earn \$60 to \$200 a Week!

Clip that Coupon Right Now! Get my Big New Book—IT'S FREE! It points the way to Success for you. Cramped full of hard, dependable, proven Facts. Shows the way to Big Pay in the Largest, Most Interesting Money-Making Field—ELECTRICITY! Find out how a world of Opportunities can be opened up for you as a Coyne-Trained Electrical Expert. See what my PRACTICAL TRAINING has done for others. Read what they say about Coyne.

### I'll Make You An Electrical Expert IN 12 WEEKS!

Yes, sir, I train you for the BIG JOBS in ELECTRICITY! Coyne IS NOT A CORRESPONDENCE SCHOOL! I train you—*thoroughly*—on thousands of dollars' worth of Electrical Apparatus. You do ACTUAL WORK on REAL EQUIPMENT—the kind you use out on the job. That's why my students MAKE GOOD. That's why you Master Electricity in 12 WEEKS at Coyne!

### Coyne Trains You For Life

It makes no difference how little Education or Electrical Experience you have had. I'll make you an Electrical Expert through Coyne's LEARN-BY-DOING METHODS! I have done it for thousands. I will do it for YOU! At Coyne you get a Life Scholarship. You can stay longer than the required time if necessary. You can return any time later to take up new work I am continually adding to keep my course up-to-date at all times.

### You Learn in Chicago the Electrical Center of the World

Coyne students master Electricity right in the Electrical Center of the World. You see everything electrical here. Along with my Shop Training you visit the big organizations and power plants—learn their methods first hand.

### Earn While You Learn

I back my students up. My Employment Dept. will assist you in getting a part time job to make a good part of your expenses while training. And it will help you get a BIG PAY JOB on graduating.

### 26 Years of Success

Remember Coyne is a School with an established REPUTATION. Endorsed by Electrical Industry. Over a QUARTER OF A CENTURY of Success that was earned by the BIG SUCCESSSES of Coyne Students. You owe it to yourself to find out what I can do for you. Clip the Coupon Now!

H. C. LEWIS, President.

**NOW!**  
Radio  
& Auto  
Course

**FREE**

Special Offer right now! I am including *absolutely free* my Big New RADIO COURSE and AUTO, TRUCK and TRACTOR ELECTRICITY. Coupon brings full details.

Send for it now. It's a book worth having. Handsomely bound. Beautifully illustrated. Size 12x15 inches. Shows dozens of actual photographs of Coyne students working in my BIG SHOPS. Gives others' experiences. Shows what you can do. Cost me a dollar, but it's yours free if you mail coupon. Do it now!

### MAIL THIS COUPON

H. C. LEWIS, President  
COYNE ELECTRICAL SCHOOL,  
1300-1310 W. Harrison St., Dept. 136-4 CHICAGO, ILLINOIS

Dear "H. C."—Please send me, *absolutely FREE*, your big New Book and full particulars of your Special Offer of Two Extra Courses *FREE*.

Name .....

Address .....

H. C. LEWIS  
President

## COYNE ELECTRICAL SCHOOL

FOUNDED  
1899

Dept. 136-4

1300-1310 W. Harrison Street

CHICAGO, ILL.





# Money Making Opportunities for "Popular Science" Readers

## Another \$25.00 IN PRIZES

To win one of these cash prizes is easy, and every reader is invited to enter this fascinating competition. Just write a letter of not over seventy words answering this question:—

**What Advertisement of "Money Making Opportunities" in this issue interests you most and why?**

Here are the prizes we will pay for the ten best letters answering the above question:—

**First Prize . . . . . \$10.00**  
**Second Prize . . . . . 5.00**  
**Third Prize . . . . . 3.00**  
**And 7 Prizes**  
**of \$1.00 each . . . . . 7.00**

First read every one of the "Money Making Opportunities" advertisements on pages 8 to 31. Check the ones that interest you. Then read over the ones you have checked and decide on the one that interests you most.

Then write a short letter, not more than seventy words, telling us why the advertisement you pick interests you most. Remember that ten prizes will be awarded. You have a good chance of winning one of them. Be sure to mail us your answer before April 1st. The prizes will be awarded, in the order of their merit, for the letters that are most interesting and best expressed.

The names of all the prize winners and the letters that win the first two prizes will be printed in this column in the June issue. Address your prize letter to

**Contest Editor**  
**POPULAR SCIENCE MONTHLY**  
**250 Fourth Ave., New York City**

### Last Month's Prize Winners

The First Prize of \$10.00 goes to M. T. Wray, Indianapolis, Ind., for his letter on the advertisement of The Logan Machine Co., Victor J. Evans & Co., and Western Security Co. Here is Mr. Wray's letter:—

Contest Editor:

The Money Making Opportunities column have introduced to me a line of advertisements which I am satisfied will prove profitable to me.

The Logan Machine Company built the products of an automobile accessory I desired, Victor J. Evans & Co., have made out the patent application, and the Western Security Company will provide the necessary production facilities.

Therefore I feel that I have reason to be truly grateful.

Yours very sincerely,  
M. T. WRAY.

Mrs. C. O. Still, of Florence, S. C. wins the Second Prize of \$5.00 for the following letter:—

Dear Editor:

The advertisement on Page 11, "Twenty-Five dollars in prizes," hit me right in the eye. Tucking it away among others, something on the order of an Easter egg hunt, is very clever of you. I had never read an advertisement until the magazine's commenced offering prizes. Now I read them all. As a consequence have used two to good advantage. I believe, both to myself and the advertiser.

Yours very truly,  
MRS. C. O. STILL.

The Third Prize goes to Mr. Robert V. Hill of Glendale, Oregon, for his letter on the advertisement of the Mayneda Company.

The winners of the other seven prizes are:—

**M. M. Sullivan, Indianapolis, Ind., R. M. Benderger, Galien, Ohio, Clifford B. Kritis, New Prague, Minn., Robert C. Thomas, Akron, Ohio, Clarence Bartman, Butler, Pa., Louis R. Murray, Ogdensburg, N. Y., and Richard E. Harper, Baltimore, Md.**

Rate 20 Cents a Word. A 10% discount is allowed on all contracts for six consecutive insertions. Advertisements intended for the June issue should be received by April 15th.

### RADIO AND SUPPLIES

**YOUR Crystal Set** will work 400 to 1000 miles if made by my plans. No tubes or batteries. Copyrighted plans \$1.00, or furnished FREE with complete parts for building set, including special coil and panel correctly drilled for only \$2.00. Satisfaction guaranteed or money refunded. Satisfied customers everywhere. Particulars free. Leon Lambert, 355 Kaufman Bldg., Wichita, Kansas.

**RADIO Generators** 500V 100 watt, \$28.50. Battery Charging Generators, \$8.50. High speed Motors. Motor Generator Sets all sizes. Motor Specialties Co., Crafton, Pennsylvania.

**WONDERFUL Discovery**—build this Radio Apparatus—It's easy; light your home free. Produce electricity from water and air! Book and 60 years' experience—It's \$1.00 Postpaid. Spark Co., Monroeville, Pa.

**2,500 MILES Distance** with one tube. Any Novice understands our simplified instructions, including Panel Layout and Photo etc. Yuma Radio Co., Box 28-117, Oakland, Calif.

### EDUCATIONAL AND INSTRUCTION

**UNION Correspondence School** courses save over half. Foreign catalogue 1000 courses free. Used courses bought. Students' Exchange, Dept. A, 47 West 42d, Street, New York.

**CORRESPONDENCE Courses** sold complete: 1-3 equal prices because slightly used; easy terms; money back guarantee. All schools and subjects. Write for special Free Catalogue. Courses bought for cash. Economy Educational Service, 302 N. West 40th St., New York.

**HIGH School, Normal, Business, Law and College** courses thoroughly taught by mail. Typewriting course free. Apply Carnegie College, Rogers, Okla.

**BOOKKEEPING** in a week, \$2 complete. Duken, 440 West 154th Street, New York.

**CORRESPONDENCE Courses**—all schools sold complete at lowest prices. Easy terms, money-back guarantee. Courses bought for cash. Catalogue Free. Mention subject. Economy Educational Service, 442-B, Bannock, San Francisco.

**DOUBLE entry bookkeeping** mastered in 60 hours; guaranteed; diploma. International Bookkeeping Institute, Springfield, Missouri, Desk 10.

**EARN \$25 weekly** spare time, writing for newspapers, magazines. Experience unnecessary. Copyright book free. Press Syndicate, 971 St. Louis, Mo.

**WORLDWIDE Masterkey**, Spanish Primer, \$1.00. Langness, 8 West 40th, New York.

**RAILROAD Postal Clerk** start \$132 month, railroad pass. Send stamps for questions. Columbus Institute, N. J. Columbus, Ohio.

**FOURTH HAND**—Easy complete course. Most rapid roadside system. First lesson papers and pamphlets for 10c postpaid. Manuscript Institute, Columbus, Virginia.

**GET a Foreman's job**. Become an expert blue print reader. Earn more money. My training will give you a bigger pay envelope quick. Send for Free Plan. Tell me what trade you want. Carroll Hummer, 201 Drexel Bldg., Philadelphia, Pa.

### BOOKS, MAGAZINES, ETC.

**LAFFALO** is a monthly devoted to wit and wisdom. Drama, Poems and Fables. Sample copy 10c. P. S. Lutz Printing Co., York, Penna.

**ENCYCLOPEDIA** all kinds, Harvard Classics. About half price. Dalton Bigger, Cully Bldg., Chicago.

**MR. ADVERTISER**: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

### SONGWRITERS, AUTHORS AND MANUSCRIPTS

**PHOTOPLAY**—story ideas wanted. \$25-\$500 paid. Experience unnecessary, outline free to artists. Write Producers League, 312 St. Louis.

**WRITERS**—stories, poems, plays, etc., are wanted for publication. Literary Bureau, 117, Hamilton, Missouri.

**I WANT** some poems. Casper Nathan, J-1252 Bryn Mawr, Chicago.

**\$50 FOR** ideas. Photoplay plots accepted any form, revised, criticized, copyrighted, marketed. Advice free. Universal Scenario Corporation, 214 Security Bldg., Santa Monica and Western Avenues, Hollywood, California.

### LANGUAGES

**IDEOPHONIC PRIMER**, \$1.94: Chinese, French, Spanish. Langness, 8 West 40th, New York.

### STAMMERING

**ST-TUT-T-T-TTERING** and stammering cured at home. Instructive booklet free. Walter McDougal, 59 Potomac Bank Building, Washington, D. C.

### AMERICAN MADE TOYS AND NOVELTIES

**OPPORTUNITY** to start Manufacturing Metal Toys and Novelties. No experience necessary. Enormous demand exceeds supply. We furnish all cast, rolling forms for production and buy entire output, also place yearly contracts orders. Casting forms made to order. Catalogue, advice and information free. Metal Craft Products Co., 1696 Boston Road, New York.

**MR. ADVERTISER**: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

**More Money Making Opportunities**  
on pages 10 to 31



# He Doesn't Know It Yet But He's a \$6,000 Man

"DO YOU SEE that earnest-looking fellow talking to the President?" — It was the General Manager speaking. He and his guest were taking a turn thru the main offices.

"That's the man I've got picked to take Short's place, as Auditor of the Company, when Short goes East. I've had my eye on him for more than a year; he's the kind of fellow who's bound to get ahead. I learned the other day that he has been studying evenings at home for the past six or eight months. He's one of the few men who really seem awake to their opportunities. A fellow like that is too good to lose, and we're going to make it worth his while to stick. He doesn't know it yet, but he's a six-thousand-dollar man!"

"Studying evenings—working out problems—taking an interest in the business"—if the men in subordinate positions could only read the minds of some of their superiors, what surprising things they would learn about themselves.

—How every day, for example, those who show promise are being appraised for bigger jobs. —How their capacity is constantly being measured by the readiness with which they grasp the larger problems of the business. —How they are being gauged by the foresight they show in preparing for greater responsibilities.

For after all, the extent to which a man is willing to *prepare* for bigger things is a mighty good index to his fitness to *control* them— isn't it?

The boss, you see—if he is a real executive and not a figurehead—put in many years equipping himself for his present position. Is it likely that he will overlook the chap who shows the same habits and tendencies which helped *him* to get ahead?

Then, too, when a man undertakes home-study training, he proves that he has good common-sense—and *that's* an asset!

For consider the logic of his undertaking—

For a comparatively few months—a year or two, at most—a man agrees with himself to give up a certain proportion of his "good time." He works as then against his ambition to increase his income, and he deliberately chooses the higher salary, the larger future. He knows that training is what he *needs* as the basis for his self-respect so highly that he cannot be happy to drift any longer.

the LaSalle Problem Method, he works with actual business problems, and they laminate him. He is conscious that he is growing in business power. He sees the results of his increased ability in the promotions that he gains.

Consider, for example, such simple statements as the following, all susceptible to ready proof:

"Salary and earnings have increased over 85 per cent. I have been able to do more than I could do without the special training and have broadened my knowledge and vision so that I have perfect confidence in my ability to do any job in the accounting field."  
FRANK D. TRISCO, Minneapolis.

"Instead of a factory storekeeper I find myself at the end of 1934 a general manager with an increase in salary of 50 per cent."  
F. H. LAWSON, Cincinnati.

"Led the list in the Mayo department."  
GORDON F. GALLIST, Chicago.

"From a salesman in the ranks to two other positions in a big business in 1934, with a 50 per cent increase in salary and a 100 per cent increase in earnings."  
C. RUTHERFORD, Canada.

"A total of 90 per cent increase in salary in two years. I now stand at the head of the department in the big business. It is a fact that I have never been more successful than when I began to study. I go to show that it pays to be prepared."  
R. L. KEEVES, Alabama.



The point to all this is very simple. In making a decision of this kind, he is demonstrating his ability to discriminate between the values that are worth while and those that are not values at all. And inevitably that kind of shrewdness makes a real hit with sound business men.

## He Learns by Solving Problems—and It's a Fascinating Method

But there's another phase to home-study training which we have neglected to mention.

While it takes courage to map out a course for oneself and to make the start, it is only a short time after one has got under way when it becomes no task at all, and instead of retarding his studies as a burden, a man gets to really looking forward to his periods of training. Under

## Make Yourself a \$6,000 Man

Of course no amount of *WISHING* can get a man out of a mediocre place and put him on the right road to success.

But what astounding things a man can do if he changes his *WISHING* to *WILLING*—if he really sets up a goal for himself and steadily bends his energies toward *REACHING* it!

What is YOUR goal? Is it symbolized by one or more of the courses listed on the coupon just below?

Then, for the sake of your future, take out your pencil NOW—check the training that appeals to you—sign your name and address—and put it in the mail.

There is, of course, no obligation—but there's a great big *OPPORTUNITY*—and it's automatically set aside for the man who *ACTS*.

# LASALLE EXTENSION UNIVERSITY

The World's Largest Business Training Institution

INQUIRY COUPON

LASALLE EXTENSION UNIVERSITY

Dept. 483-R

Chicago, Illinois

Please send me catalog and full information regarding the course and service I have marked with an X below.

Also a copy of "Ten Years' Promotion in One" without obligation to me.

☐ Business Management Training for Office Managers, Sales and Departmental Executive positions.

☐ Traffic Management Foreign and Domestic Training for position as Railroad or Maritime Traffic Manager, Rate Expert, Freight Selector, etc.

☐ Industrial Management Efficiency Training for positions in Works Management, Production Control, Industrial Engineering, etc.

☐ Business English Training for Business Correspondence and Copy Writers.

☐ Modern Salesmanship Training for position as Sales Executive, Salesman, Sales Coach or Trainer, Sales Promotion Manager, Manufacturer's Agent, Solicitor, and all positions in retail, wholesale, or specialty selling.

☐ Railway Station Management Training for position of Station Accountant, Cashier and Agent, Division Agent, etc.

☐ Personnel and Employment Management Training in the position of Personnel Manager, Industrial Relations Manager, Employment Manager and position relating to Employee Service.

☐ Commercial Spanish Training for position as Foreign Correspondent with Spanish-speaking countries.

☐ Higher Accountancy Training for position as Auditor, Comptroller, Certified Public Accountant, Cost Accountant, etc.

☐ Banking and Finance Training for executive positions in Banks and Financial Institutions.

☐ Modern Business Correspondence and Practice Training for position as Sales or Collection Correspondent, Sales Promotion Manager, Mail Sales Manager, Secretary, etc.

☐ Effective Speaking Training in the art of forceful, effective speech for Ministers, Salesmen, Fraternal Leaders, Publicists, etc.

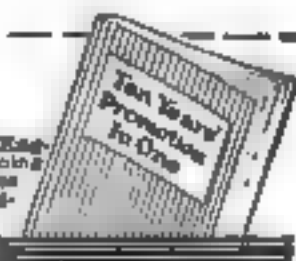
☐ Law Training for Bar: LL. B. Degree.

☐ Modern Merchandising and Production Methods Training for positions in Shop Management such as that of Superintendent, General Foreman, Foreman, Sub-Foreman, etc.

☐ Expert Bookkeeping Training for position as Head Bookkeeper.

☐ C. P. A. Coaching for Advanced Accountants.

Name \_\_\_\_\_ Present Position \_\_\_\_\_ Address \_\_\_\_\_







## See How Easy It Is To Learn Music This New Way

**Y**OU know how easy it is to put letters together and form words, once you have learned the alphabet. Playing a musical instrument is not very much different. Once you learn the notes, play on melodies on the piano, violin, guitar or violin is simply a matter of putting the notes together correctly. The first note shown above is F. Whether you are singing from notes, playing on the piano or guitar or any other musical instrument, that note in the first space is always F. The four notes indicated are F, A, C, E, easy to remember because they spell the word "FACE". Certain strings on the mandolin, certain keys on the piano represent these same notes and once you learn them, playing melodies on the instrument is as easy as saying the letters of the word. A new simplified method of teaching reduces all music to its simplest possible form. You can now play on any instrument without a teacher. A new simplified method of teaching reduces all music to its simplest possible form. You can now play on any instrument without a teacher. A new simplified method of teaching reduces all music to its simplest possible form. You can now play on any instrument without a teacher.

Practice is essential and continuous but it is fun the new way. You will begin to play melodies almost from the start. The "Picture-Play" method of self-teaching is fun because it is simply a matter of learning the meaning of a few letters. You learn that the note in the first space is F and that a certain key on the piano is F. Thereafter you will always be able to read F and play it whenever you see it. Just as you are able to recognize the letters that make a word, you will be able to recognize and play the notes that make a melody. It's easy, interesting.

You don't have to know anything whatever about music, learn to play a musical instrument the new way. You don't have to join yourself, learn to recognize notes, to read or listen. You practice whenever you can, learn as quickly as you please. All the intricate "mysteries" of music have been reduced to a method of learning simplicity—each step is made as clear as ABC. Thousands have already learned to play their favorite musical instruments this splendid new quick way.

### You Can Play Your Favorite Instrument Three Months from Today

If you are dissatisfied with your present work, let music act as a stepping stone into a new career. If you long for a hobby, a means of self-expression, let music be the new interest in your life. If you wish to be a social favorite, if you wish to gain popularity, choose your favorite instrument and through the wonderful home-study method of the U. S. School of Music, play it three months from today.

You can do it. Youngsters of 10 to 17 years have done it and men as old as 60 have found new interest and enjoyment in learning how to play a musical instrument. You don't have to listen while others entertain any longer. YOU can be the center of attraction. The talented person who holds the audience fascinated.

Is it the piano you wish to play, the mandolin, the violin, the saxophone? Do you want to learn how to sing from notes? Are you eager to be able to play "jazz" on the clarinet, the banjo?

### LEARN TO PLAY ANY INSTRUMENT

|                          |                          |
|--------------------------|--------------------------|
| Piano                    | Drums and                |
| Organ                    | Traps                    |
| Violin                   | Harmony and              |
| Banjo                    | Composition              |
| Clarinet                 | Sight Singing            |
| Flute                    | Lyrics                   |
| Harp                     | Percussion               |
| Cornet                   | Trombone                 |
| Cello                    | Guitar                   |
| Saxophone                | Steel Guitar             |
| Mandolin                 | Voice and Speech Culture |
| Automatic Finger Control | Piano Accordion          |

### FREE BOOK Explains All—Send Today

Send for our free book called "Music Lessons in Your Own Home." Every one who is interested in music should read it once for this valuable book. It not only explains the wonderful new simplified method of learning music, but tells about a special offer, one other now being made to music lovers.

With it will be sent an illustrated folder which proves, better than words, how delightfully quick and easy the famous Print-and-Picture Method is. Mail this coupon at once for your copy. Remember it obligates you in no way whatever. But act now before the supply is exhausted.

U. S. SCHOOL OF MUSIC  
34 Brunswick Building, N. Y. C.

Please write plainly)

### U. S. SCHOOL OF MUSIC 34 Brunswick Building, N. Y. C.

Please send me your free book, "Music Lessons in Your Own Home," with introduction by Dr. Frank Crane, illustrated folder and particulars of your special offer. I am interested in the following course:

Have you played instrument?

Name

Address

City

State

## \$25.00 in PRIZES

See top page 8 in front of book for details



## WANTED! Get \$1600 to \$2300 a Year

### U.S. RAILWAY MAIL CLERKS

### Men—Boys 18 up Should Mail Coupon Immediately

Franklin Institute, Dept. A274, Rochester, N. Y.  
We send you, without charge, (1) sample Railway Mail Clerk Examination questions; (2) tell me how to get a U. S. Government job; (3) and free sample teaching lessons; (4) send copy of illustrated book, "How to Get Government Jobs."

Name \_\_\_\_\_  
Address \_\_\_\_\_

Steady Work—No Layoffs—Paid Vacations  
Travel—See Your Country  
MAIL COUPON TO-DAY—SURE

## Money Making Opportunities

### PRINTING, ENGRAVING AND MULTICOLORING

**BETTER PRINTING** for less money. Write on about your printing needs, and you will save money. Broad Point Company, 525 South Dearborn Street, Chicago.

**ENGRAVED** business personal stationery. Samples, stamp. Daniels P. Engraving Co. 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.

**200 SHEETS** 100 engravings on high Ray Apple Paper, bound \$2.00. On average gummed labels from. Label Co., 1010 Pennsylvania.







## \$2500 REWARD For the Capture of An Unknown Man

**TWICE** he had entered the St. Clair Mansion. What was he after? Who? What was in danger?

Bertau, the famous detective, had warned St. Clair that the mysterious murderer would come again. And now—a noise in the passage! The creak of an opening door. A shot in the dark! A capture!

Is this wounded stranger the mysterious intruder? Who could tell? Yet Bertau identified the man without hesitation and won the \$2500 reward.

How did he do it? Easy enough for the Finger Print Expert. He is the specialist the leader the crown of detectives. Every day's paper tells of their wonderful exploits in solving mysterious crimes and convicting dangerous criminals.

## More Trained Men Needed

The demand for trained men by governments, states, cities, detective agencies, corporations, and private bureaus is becoming greater every day. Here is a real opportunity for YOU. Can you imagine a more fascinating line of work than this? Often life and death depend on finger print evidence—and big rewards go to the expert. Many experts earn regularly from \$3,000 to \$10,000 per year.

## Learn at Home in Spare Time

And now you can learn the secrets of this science at home in your spare time. Any man with common school education and average ability can become a Finger Print Detective in surprisingly short time.

## Free Course in Secret Service

For a limited time we are making a special offer of a Professional Finger Print Guide, absolutely free, and Free Course in Secret Service Intelligence. Mastery of these two kindred professions will open a brilliant career for you.

Write quickly for fully illustrated free book on Finger Prints which explains this wonderful training in detail. Don't wait until this offer has expired—mail the coupon now. You may never see this announcement again! You assume no obligation you have everything to gain and nothing to lose. Write at once—ad.

**University of Applied Science**  
Dept. 12-64, 1920 Sunnyside Ave., Chicago, Ill.

**UNIVERSITY OF APPLIED SCIENCE**  
Dept. 12-64, 1920 Sunnyside Ave., Chicago, Ill.

Gentlemen: Without any obligation whatever send me now fully illustrated FREE book on Finger Prints and the offer of a FREE course in Secret Service Intelligence and the Free Professional Finger Print Guide.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
Present Occupation \_\_\_\_\_

## Money Making Opportunities

### MUSIC AND MUSICAL INSTRUMENTS

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### PHOTOGRAPHY AND OPTICS

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### FOR MEN AND WOMEN

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### MISCELLANEOUS

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### HOW TO ENTERTAIN

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### LAUNY AND ENTERTAINMENT

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### MAKING BOOKS

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### CHALK TALKS

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### COOKING

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### INSIDE WANTED

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### OPTICAL GOODS

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### CHOCOLATES AND CIGARETTES

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### WANTED

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### REAL ESTATE BROKERS

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### ROAST AND LAUNCHES

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### More Money Making Opportunities

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### More Money Making Opportunities

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### More Money Making Opportunities

WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

### More Money Making Opportunities

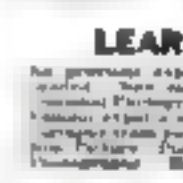
WANT TO SELL? Five months' experience. Various Music. 1000-1000 N.Y.

# \$700 a week

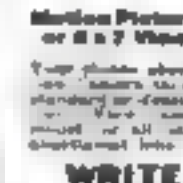
from his own  
*Photograph Studio*



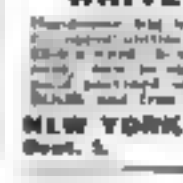
My income now averages from \$700 to \$1000 a week. I have a studio in my home and I am a successful photographer. I have a large number of clients and I am a successful business man. I have a large number of clients and I am a successful business man.



My income now averages from \$700 to \$1000 a week. I have a studio in my home and I am a successful photographer. I have a large number of clients and I am a successful business man. I have a large number of clients and I am a successful business man.



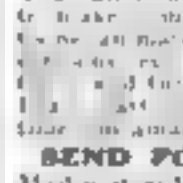
My income now averages from \$700 to \$1000 a week. I have a studio in my home and I am a successful photographer. I have a large number of clients and I am a successful business man. I have a large number of clients and I am a successful business man.



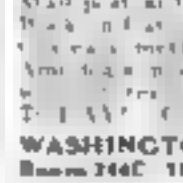
My income now averages from \$700 to \$1000 a week. I have a studio in my home and I am a successful photographer. I have a large number of clients and I am a successful business man. I have a large number of clients and I am a successful business man.



My income now averages from \$700 to \$1000 a week. I have a studio in my home and I am a successful photographer. I have a large number of clients and I am a successful business man. I have a large number of clients and I am a successful business man.



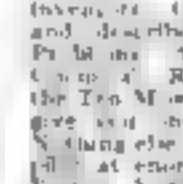
My income now averages from \$700 to \$1000 a week. I have a studio in my home and I am a successful photographer. I have a large number of clients and I am a successful business man. I have a large number of clients and I am a successful business man.



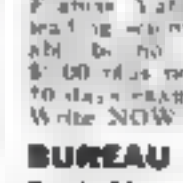
My income now averages from \$700 to \$1000 a week. I have a studio in my home and I am a successful photographer. I have a large number of clients and I am a successful business man. I have a large number of clients and I am a successful business man.



My income now averages from \$700 to \$1000 a week. I have a studio in my home and I am a successful photographer. I have a large number of clients and I am a successful business man. I have a large number of clients and I am a successful business man.



My income now averages from \$700 to \$1000 a week. I have a studio in my home and I am a successful photographer. I have a large number of clients and I am a successful business man. I have a large number of clients and I am a successful business man.



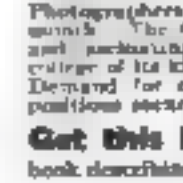
My income now averages from \$700 to \$1000 a week. I have a studio in my home and I am a successful photographer. I have a large number of clients and I am a successful business man. I have a large number of clients and I am a successful business man.



My income now averages from \$700 to \$1000 a week. I have a studio in my home and I am a successful photographer. I have a large number of clients and I am a successful business man. I have a large number of clients and I am a successful business man.



My income now averages from \$700 to \$1000 a week. I have a studio in my home and I am a successful photographer. I have a large number of clients and I am a successful business man. I have a large number of clients and I am a successful business man.



My income now averages from \$700 to \$1000 a week. I have a studio in my home and I am a successful photographer. I have a large number of clients and I am a successful business man. I have a large number of clients and I am a successful business man.



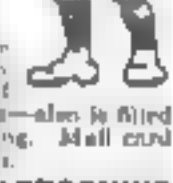
My income now averages from \$700 to \$1000 a week. I have a studio in my home and I am a successful photographer. I have a large number of clients and I am a successful business man. I have a large number of clients and I am a successful business man.

## New Easy Way to Learn CARTOONING

You can now quickly learn to make money at home. This is a new and easy way to learn cartooning. You can now quickly learn to make money at home. This is a new and easy way to learn cartooning.



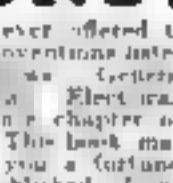
You can now quickly learn to make money at home. This is a new and easy way to learn cartooning. You can now quickly learn to make money at home. This is a new and easy way to learn cartooning.



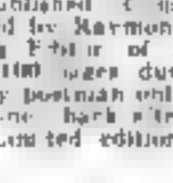
You can now quickly learn to make money at home. This is a new and easy way to learn cartooning. You can now quickly learn to make money at home. This is a new and easy way to learn cartooning.



You can now quickly learn to make money at home. This is a new and easy way to learn cartooning. You can now quickly learn to make money at home. This is a new and easy way to learn cartooning.



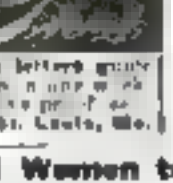
You can now quickly learn to make money at home. This is a new and easy way to learn cartooning. You can now quickly learn to make money at home. This is a new and easy way to learn cartooning.



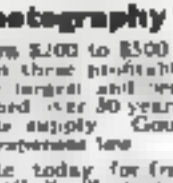
You can now quickly learn to make money at home. This is a new and easy way to learn cartooning. You can now quickly learn to make money at home. This is a new and easy way to learn cartooning.



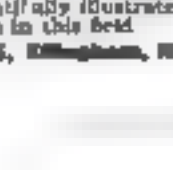
You can now quickly learn to make money at home. This is a new and easy way to learn cartooning. You can now quickly learn to make money at home. This is a new and easy way to learn cartooning.



You can now quickly learn to make money at home. This is a new and easy way to learn cartooning. You can now quickly learn to make money at home. This is a new and easy way to learn cartooning.



You can now quickly learn to make money at home. This is a new and easy way to learn cartooning. You can now quickly learn to make money at home. This is a new and easy way to learn cartooning.



## 1000 NEEDED INVENTIONS!

Here is the most remarkable book ever offered to inventors. It contains 1000 inventions that are needed in the world. It contains 1000 inventions that are needed in the world.

Here is the most remarkable book ever offered to inventors. It contains 1000 inventions that are needed in the world. It contains 1000 inventions that are needed in the world.

Here is the most remarkable book ever offered to inventors. It contains 1000 inventions that are needed in the world. It contains 1000 inventions that are needed in the world.

Here is the most remarkable book ever offered to inventors. It contains 1000 inventions that are needed in the world. It contains 1000 inventions that are needed in the world.

Here is the most remarkable book ever offered to inventors. It contains 1000 inventions that are needed in the world. It contains 1000 inventions that are needed in the world.

Here is the most remarkable book ever offered to inventors. It contains 1000 inventions that are needed in the world. It contains 1000 inventions that are needed in the world.

Here is the most remarkable book ever offered to inventors. It contains 1000 inventions that are needed in the world. It contains 1000 inventions that are needed in the world.

Here is the most remarkable book ever offered to inventors. It contains 1000 inventions that are needed in the world. It contains 1000 inventions that are needed in the world.

Here is the most remarkable book ever offered to inventors. It contains 1000 inventions that are needed in the world. It contains 1000 inventions that are needed in the world.

## Wanted Men and Women to Learn Photography?

Photographers and Photo Engravers earn \$200 to \$500 a month. The field is unlimited. Learn these profitable and exciting professions. Taught by largest and best college of its kind in the world. Established over 30 years. Demand for our graduates far exceeds supply. Good positions secured. Tuition and living expenses low.

Photographers and Photo Engravers earn \$200 to \$500 a month. The field is unlimited. Learn these profitable and exciting professions. Taught by largest and best college of its kind in the world. Established over 30 years. Demand for our graduates far exceeds supply. Good positions secured. Tuition and living expenses low.

Photographers and Photo Engravers earn \$200 to \$500 a month. The field is unlimited. Learn these profitable and exciting professions. Taught by largest and best college of its kind in the world. Established over 30 years. Demand for our graduates far exceeds supply. Good positions secured. Tuition and living expenses low.

Photographers and Photo Engravers earn \$200 to \$500 a month. The field is unlimited. Learn these profitable and exciting professions. Taught by largest and best college of its kind in the world. Established over 30 years. Demand for our graduates far exceeds supply. Good positions secured. Tuition and living expenses low.

Photographers and Photo Engravers earn \$200 to \$500 a month. The field is unlimited. Learn these profitable and exciting professions. Taught by largest and best college of its kind in the world. Established over 30 years. Demand for our graduates far exceeds supply. Good positions secured. Tuition and living expenses low.

Photographers and Photo Engravers earn \$200 to \$500 a month. The field is unlimited. Learn these profitable and exciting professions. Taught by largest and best college of its kind in the world. Established over 30 years. Demand for our graduates far exceeds supply. Good positions secured. Tuition and living expenses low.

Photographers and Photo Engravers earn \$200 to \$500 a month. The field is unlimited. Learn these profitable and exciting professions. Taught by largest and best college of its kind in the world. Established over 30 years. Demand for our graduates far exceeds supply. Good positions secured. Tuition and living expenses low.

Photographers and Photo Engravers earn \$200 to \$500 a month. The field is unlimited. Learn these profitable and exciting professions. Taught by largest and best college of its kind in the world. Established over 30 years. Demand for our graduates far exceeds supply. Good positions secured. Tuition and living expenses low.

Photographers and Photo Engravers earn \$200 to \$500 a month. The field is unlimited. Learn these profitable and exciting professions. Taught by largest and best college of its kind in the world. Established over 30 years. Demand for our graduates far exceeds supply. Good positions secured. Tuition and living expenses low.



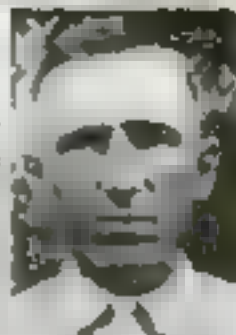
# Be a Cooke-Trained AUTO EXPERT

I Guarantee to  
Train You  
AT HOME



EARN  
\$3500 to \$10000  
A YEAR

Start to Make  
Money Quick  
Like Harrison



Mr. J. Harrison  
Parkersburg, W. Va.



Clip This Now-for my Big  
FREE AUTO BOOK

## The World's biggest, most fascinating business needs you!

You needn't slave away at small wages another minute—mail coupon and I'll tell you how I train you at home in your spare time for positions paying \$75 to \$200 a week. I am ed opportunity waiting for Cooke-trained Auto Experts. Let me show you how my "JOB-WAY" training has prepared hundreds of men just like yourself for a quick, brilliant success in the Auto business.

### Earn \$75 to \$200 a Week!

Don't sell your time for a penny less! You don't need to when you have my wonderful training. As Directing Engineer of the great Chicago Auto Shops I know what training you need to succeed, AND I GIVE YOU THAT TRAINING. Right in your own home I make you MASTER of every branch of Auto, Truck and Tractor work. I train you with JOBS—not books. I bring the original "JOB-WAY" training TO YOUR HOME!

#### Read My Guarantee!

I guarantee in my big free Auto Book— "I'll give you money if after receiving my training you are not absolutely satisfied." This just alone makes my "JOB-WAY" course the cradling of you! Be sure to get my book and read all 10 guarantees—this must amazing promise offered by any school as early!

#### Experience, Education Not Needed!

I don't care how long schooling you have. I'll make you a successful Auto Expert at a rapid rate! Boys and men of all ages have become garage owners and managers, Superintendents, Foremen, Auto Experts. Here, PAY executives, after completing Cooke "JOB-WAY" training I prove to you under bond that I will prepare you to take advantage of the many wonderful opportunities of the great auto business!

#### Get My Big Book Quick!

I will send it to you with-out one penny of cost. Read all the facts that are at the demand for Cooke-trained Auto Experts. Let me tell you how easily and quickly you, too, may become an Auto Expert. Special offer right now to millions men. Coupon brings complete information. Act now!

#### No Other Training Like Mine!

My training includes A. L. Electrical work—Ignition, Starting, Lighting—All Mechanical and Welding, Boring, Vulcanizing—also Business Course, Salesmanship, Advertising, Buying, How to keep Sales Books—also Free Monthly Magazine, also 2 Free Outfits. Nowhere else I know of, can get you ALL this training.

Tom Wilson, dollars spent each year to repair 150000 Autos, Trucks, Tractors. It's the world's largest business. Amazing money opportunities everywhere for trained men. My Free Final report Service helps you to big jobs, and I help you to get into business for yourself.

#### Tools and Test Bench Equipment Free

I supply every Cooke "JOB-WAY" graduate with 240—complete ready outfit absolutely free! (Book only). Give me three dollars to finish money shortly after starting the first day. (No charge for this outfit.)

FREE!  
Big  
2  
Repair  
Outfits

Address Me Personally **B. W. Cooke** Directing Engineer  
**CHICAGO AUTO SHOPS**

Dept. 425

1916 SUNNYSIDE AVENUE,

CHICAGO

### MAIL THIS COUPON NOW!

#### FREE AUTO BOOK

**B. W. COOKE**, Directing Engineer, Chicago Auto Shops  
Dept. 425, 1916 Sunnyside Avenue, Chicago

Send me FREE your big Auto Book "The Pay-Raiser" and proof that I can become an Auto Expert at home in spare time. Also reserve 2 Free outfits without obligating me.

Name.....

Address.....

City..... State.....









BE AN ARCHITECT  
\$8,000 to \$15,000 a year



BE A DRAFTSMAN  
\$4,000 to \$10,000 a year



BE AN EXPERT ACCOUNTANT  
\$2,000 to \$12,000 a year



BE A CIVIL ENGINEER  
\$4,000 to \$15,000 a year



BE AN EXPERT DRAFTSMAN  
\$2,000 to \$10,000 a year



BE AN ELECTRICAL EXPERT  
\$2,000 to \$12,000 a year



BE A LAWYER  
\$1,000 to \$15,000 a year



BE A MECHANICAL ENGINEER  
\$1,000 to \$15,000 a year



BE A STEAM ENGINEER  
\$2,500 to \$7,500 a year



BE A BUSINESS EXPERT  
\$2,000 to \$10,000 a year



BE AN EXPERT ACCOUNTANT  
\$4,000 to \$12,000 a year



O. C. MILLER  
Director of Extension

If you're in doubt about what home training will do for you, read this guarantee.

AMERICAN SCHOOL, home training, will guarantee two months' employment with a salary of at least \$500 a month. If not, we will not cost you a penny.

**I Guarantee you a 50% Raise**

If you are now earning less than \$40 a week, and if for any one of our 13 home training courses, and we guarantee within sixty days after you finish to find you a position paying 50% more than your present salary. If not, we will refund every cent of the tuition. AMERICAN SCHOOL, home training, will not cost you a penny. If not, we will not cost you a penny.

After you finish or money refunded!

## Training the quick road to Big Pay!

World's biggest business boom is coming and with it an enormous demand in a dozen industries for EXPERTS at \$50 to \$100 a week! You can't cash in on this opportunity in the old, slow "experience" way. You must TRAIN—you must SPECIALIZE! AMERICAN SCHOOL has made it easy for you to get just the training you need to gain promotion and bigger pay QUICK. Get the facts—find out what success thousands of others have gained with AMERICAN home-training—why these 13 courses carry a guarantee of a 50% raise or money back—how AMERICAN SCHOOL has secured over 200 of the leaders in these industries, prominent engineers, educators and business men, to guide you quickly to the Expert's job and pay.



### TRAIN AT HOME!

Business, like Life, is—WAR! You must fight ALONE for every inch of progress. So you need the help our home-training will bring you to meet and beat the competition of your fellow-workers. Loan me a part of your spare-time, and right in your own home I will show you how to win your battles for promotion. I will prepare you for the success and prosperity that are now beyond your reach.

### Are Trained Men "Lucky"?

If you're a \$25 a week man now, you are limited to \$25 a week opportunities. The \$10,000 opportunity is over your head. Only the trained Expert, the specialist, can take advantage of the big-money opportunities. That's all there is to "luck"—being able to grab the big opportunities when they come along. So you see TRAINING must come first.

O. C. MILLER, Director of Extension

**AMERICAN SCHOOL**

Dpt. G-475 Drexel Ave. and 58th St., Chicago

### Choose from 13 Courses

#### All 50% Raise Guaranteed

Here is the chance you've been waiting for to get into your true line of profession or business. AMERICAN SCHOOL guarantees complete instruction in these 13 great lines. Our plan of operation costs very little tuition. Costs far less than other methods. Common sense and ability needed. You will be astonished at the many features of our excellent service. While you are training and afterward, we help you at every step.

### More Surprises!

#### Write for my offers today!

I want to tell you more about the opportunities which HOME-TRAINING brings within your reach. I want to tell you more about what the AMERICAN SCHOOL has done for others and can do for you. I have some interesting fact that you ought to have RIGHT NOW. I want to tell you all about our 50% Raise guarantee. Mail coupon for complete information. Address me personally.

### Earn While You Learn!

You don't have to wait until you finish your training to benefit financially. Many students report higher income and extra money while studying. AMERICAN SCHOOL will help you find a way to earn while you learn. We will help you find a way to earn while you learn. We will help you find a way to earn while you learn.

Here is your coupon

**SEND ME FREE BOOK and GUARANTEE of 50% RAISE**

O. C. MILLER, Director of Extension  
AMERICAN SCHOOL, Dept. G-475  
Drexel Ave. and 58th St., Chicago

Send me at once complete information about the home-training marked "X" below

- ☐ Architecture
- ☐ Contracting Building
- ☐ Civil Engineering
- ☐ Electricity
- ☐ Drafting
- ☐ Law
- ☐ Steam
- ☐ Structural Engineering
- ☐ Mechanical Engineering
- ☐ Business Management
- ☐ Higher Accounting and C. P. A.
- ☐ Steam Engineering
- ☐ High School, 2 years

Name

St. No.

City

State



# This Man is Sure of His Job



HE SAW the handwriting on the wall. Men in his department were being dropped right and left. He might have been the next to go but for a familiar coupon which he saw one day in a magazine. He marked it, and mailed it to Scansion.

Then one day his employer called him in.

"Young man," he said, "I have just received a letter from the International Correspondence Schools telling me you have enrolled and have received a mark of 91 for your first lesson."

"I don't mind saying that this letter has saved your job. I had you on the list of men to be dropped. But I'm going to keep you now. The man who thinks enough of his future to study his job is the kind of a man we want around here."

HOW about you? Are you sitting on the sidelines, wondering if you will be the next to go? Are you training yourself so that you will not only be sure of your present job, but will be ready for the job ahead?

No matter where you live, the I. C. S. will come to you. No matter how mixed or previous education, the specially written material is illustrated. I. C. S. textbooks make it easy to learn.

This is all we ask. Without cost or obligation, put it up to us to prove how we can help you.

**Mail the Coupon for Free Booklet**

**INTERNATIONAL CORRESPONDENCE SCHOOLS**  
Box 7841 O, Scranton, Penna.

Without cost or obligation on my part, please tell me how I can qualify for the position of in the subject below which I have marked with X.

## BUSINESS TRAINING COURSES

- |  |                                       |
|--|---------------------------------------|
| <input type="checkbox"/> Business Management           | <input type="checkbox"/> Bookkeeping  |
| <input type="checkbox"/> Office Management             | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Personnel Management          | <input type="checkbox"/> Dictation    |
| <input type="checkbox"/> Traffic Management            | <input type="checkbox"/> French       |
| <input type="checkbox"/> Business Law                  | <input type="checkbox"/> Spanish      |
| <input type="checkbox"/> Banking and Banking Law       | <input type="checkbox"/> Bookkeeping  |
| <input type="checkbox"/> Accounting and Accounting Law | <input type="checkbox"/> Bookkeeping  |
| <input type="checkbox"/> Bookkeeping and Accounting    | <input type="checkbox"/> Bookkeeping  |
| <input type="checkbox"/> Bookkeeping and Accounting    | <input type="checkbox"/> Bookkeeping  |

## TECHNICAL AND INDUSTRIAL COURSES

- |   |  |
|---|--|
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Architecture              |
| <input type="checkbox"/> Mechanical Engineering | <input type="checkbox"/> Architectural Blue Prints |
| <input type="checkbox"/> Chemical Engineering   | <input type="checkbox"/> Civil Engineering         |
| <input type="checkbox"/> Mining Engineering     | <input type="checkbox"/> Mechanical Drafting       |
| <input type="checkbox"/> Metallurgy             | <input type="checkbox"/> Mechanical Drafting       |
| <input type="checkbox"/> Steam Engineering      | <input type="checkbox"/> Mechanical Drafting       |
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Mechanical Drafting       |
| <input type="checkbox"/> Mechanical Engineering | <input type="checkbox"/> Mechanical Drafting       |

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_

Occupation \_\_\_\_\_

Persons residing in Canada should send this coupon to the International Correspondence Schools, Limited, Montreal, Canada.

## Music Lessons

**At Home**

Any Instrument

SEND for a FREE CATALOG

University Extension Conservatory, 1001 Maple Street, Chicago

## A Business for All

A permanent business. Large, quick profits for men and women. Work anywhere, full or part time. Every one can succeed. Cost only \$1.00.

Learn to 10 lessons, on ex-perience necessary. A valuable business opportunity. A business for all. We furnish capital, free instruction.

TANLEY CO. 300 Main, Muscatine, Iowa

## Money Making Opportunities

### PATENT ATTORNEYS

**PATENTS** Protected Trade Marks Registered. A comprehensive expert advice, prompt service for the protection of your rights. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**TRADE MARKS** Registered. Design patents. Copy-right. 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

**PATENT** For new and improved. Free, no obligation. Informal and for the purpose. Patent Attorney, 1000 Broadway, New York City. Phone 1000.

## EARN \$2,000 TO \$10,000 A YEAR



**TRAINED**

**AUTO MEN ARE WANTED!**

Why work for small pay?

Learn a good trade. Know

autos. How to repair them.

Get a better job—NOW! Or a business of your own. I can train you in a few weeks here at my great auto trade school in the heart of the auto industry. Think of the repair work on fifteen million cars! There are not nearly enough trained men to do this work. You can be a skilled mechanic and auto electrician and EARN BIG MONEY. Experience isn't necessary. If you are mechanically inclined come to Detroit now, to my School.

## Learn Autos in Detroit (THE HEART OF THE INDUSTRY)

Here you have wonderful advantages. Study auto, trucks, engines, auto-electricity, traction, auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.

Auto-electricity, traction, auto-electricity, traction.



















# Money Making Opportunities

## HELP WANTED

**MAIN \$1.20 an hour** cutting blanks at home spare time. Main only. Send addressed reply envelope. Goodyear Bldg., 147 W. 32nd St., New York.

**WANTED:** Representatives in every factory in the United States. Popular Science Monthly 350 Fourth Ave., New York.

**MPN to build radio sets** in spare time. Low Low Bldg., 556-11 Kaufman Bldg., Wichita, Kansas.

**REVEAL NO Mirror, French plate, easily learned.** Immediate profits. Home free. Wear Mirror Works, 13 Celeste Bldg., N.Y.

**ON A genuine gulf window sign letters** are an excellent money-making proposition for handy men. Home Sign System East Bethune Avenue, Detroit, Michigan.

**MPN want our formal ranger, postal clerk and other government positions, particulars free.** Write Hissman, Dept. 4, 100 New York.

**EARN \$3.00 to \$15.00 weekly** mailing circulars at home. Part and instruction free. Jamette, 1205 Grand Plaza, Pa.

**1000 \$100 WEEKLY** Men with slight knowledge of business who can reach out owners can earn \$1000 weekly without making a single sale. If they can also make sales, profits may reach \$25,000 yearly. W. Y. Phillips, 333 West 37th St., New York.

**After you get it early** see our advertisement on page 14 of this issue. The Electric Thermal Company, 404 Main, Haverhill, Mass.

**Make Money easily** without at home spare time. Haverhill Mirror, 1100 Main, Haverhill, Mass. Haverhill, Mass. Haverhill, Mass.

**If you want to distribute free samples, circulars, etc.** in your local y. write quick. Absolutely no selling. Excellent pay. Home Advertising Co., Denver 400, Kansasville, Mo.

**ALL ADVERTISERS** Ask today for a copy of the "Quick Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'll like to know. Wouldn't you? Address your inquiry to Manager, Classified Advertising, Popular Science Monthly, 230 Fourth Ave., New York.

## STAMPS AND COINS

**STAMPS:** Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000.

**COINS:** Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000.

**STAMPS:** Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000.

**COINS:** Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000.

**STAMPS:** Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000.

**COINS:** Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000.

**STAMPS:** Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000.

**COINS:** Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000.

**STAMPS:** Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000.

**COINS:** Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000.

**STAMPS:** Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000.

**COINS:** Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000.

**STAMPS:** Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000.

**COINS:** Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000.

**STAMPS:** Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000.

**COINS:** Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000.

**STAMPS:** Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000.

**COINS:** Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000.

**STAMPS:** Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000.

**COINS:** Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000.

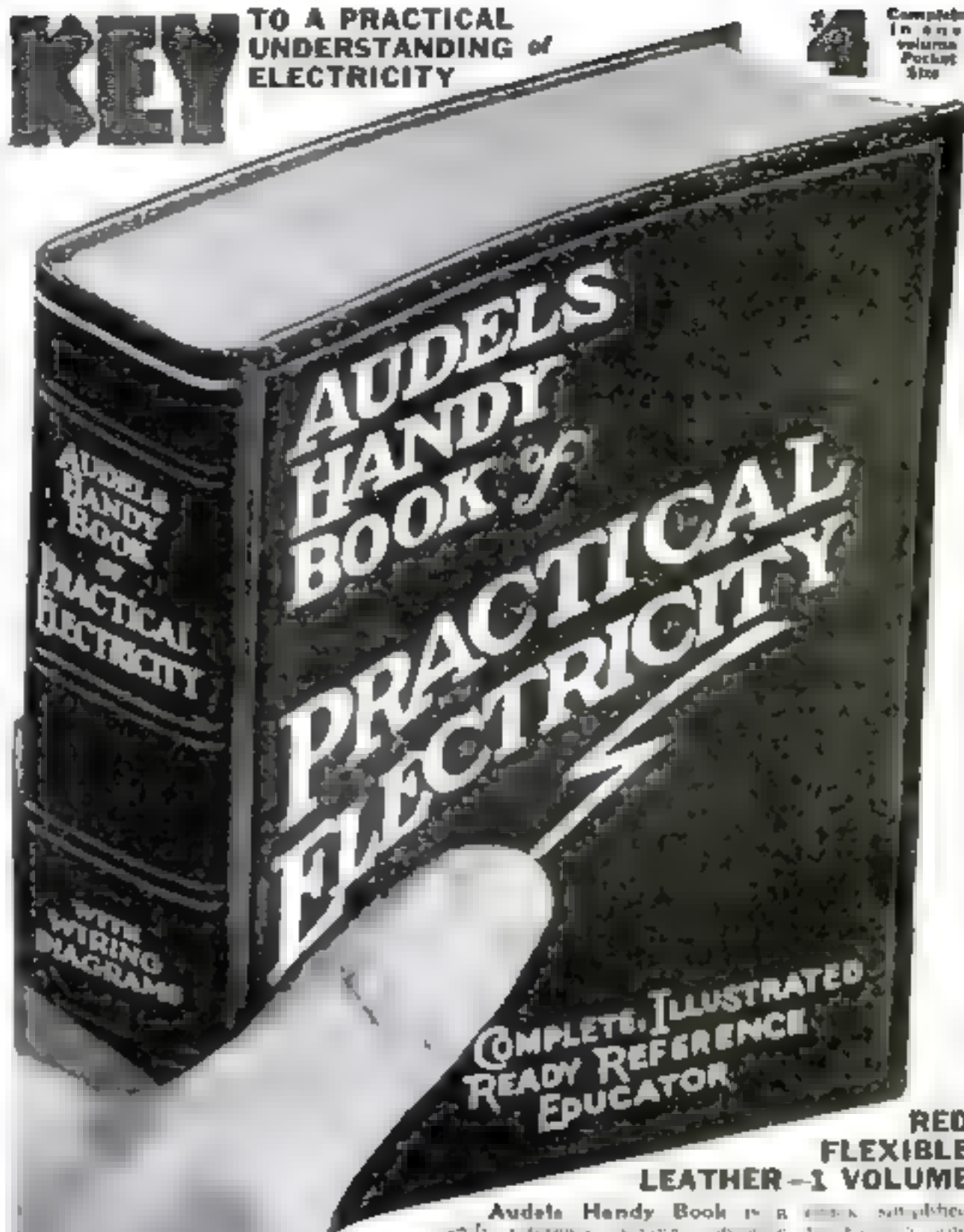
**STAMPS:** Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series stamps, 100000000, large 1.00 U. S. Rev. 100000000.

**COINS:** Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000. Complete and perfect set of 40 different series coins, 100000000, large 1.00 U. S. Rev. 100000000.

More Money Making Opportunities on pages 8 to 20

# KEY TO A PRACTICAL UNDERSTANDING OF ELECTRICITY

4 Complete in one volume Pocket Size



## RED FLEXIBLE LEATHER—1 VOLUME

Audels Handy Book is a book simplified early reference. Every electrician, plumber, and carpenter should have it. It contains 1040 pages and 2600 diagrams. It is a complete reference for all practical electric work. It is a book that every electrician should have. It is a book that every electrician should have. It is a book that every electrician should have.

## On every subject arranged in HANDY FORM under these CHAPTER HEADINGS:

|                       |                         |                      |
|-----------------------|-------------------------|----------------------|
| Electric Therapeutics | Power Sources           | Heat                 |
| Electric Shock        | Armature Winding        | Conductors           |
| Welding               | Armature Repairing      | Transformers         |
| Welding               | A. C. Motor             | Power Factor         |
| Welding               | Alternator Construction | Alternating Currents |
| Welding               | Armature Construction   | D. C. Apparatus      |
| Welding               | D. C. Motors            | Switches             |
| Welding               | Dynamometers            | Fuses                |
| Welding               | Magnetic Induction      | Circuit Breakers     |
| Welding               | Wiring Diagrams         | Phone Sets           |
| Welding               | Electric Lathes         | Watt (at Rules)      |
| Welding               | Sign Flashers           | Electric Pliers      |
| Welding               | Wiring Diagrams         | Electric Saws        |
| Welding               | Power Wiring            | Storage Batteries    |
| Welding               | Underground Wiring      | Magnetism            |
| Welding               | Outside Wiring          | Electrical Energy    |
| Welding               | Wiring Diagrams         | Mechanical Energy    |
| Welding               | Wiring Diagrams         | Conductors           |
| Welding               | Wiring Diagrams         | Static Electricity   |
| Welding               | Wiring Diagrams         | Dynamic Electricity  |
| Welding               | Wiring Diagrams         | Magnetism            |
| Welding               | Wiring Diagrams         | Radio Electricity    |
| Welding               | Wiring Diagrams         | Power Applications   |
| Welding               | Wiring Diagrams         | Ready Reference      |
| Welding               | Wiring Diagrams         | Index on subjects    |

# FREE EXAMINATION

Send no money. Pay nothing to postman. Examine book absolutely free. No obligation to buy unless satisfied. If you want to keep the Handy Book, send \$1 within 7 days and \$1 monthly until \$4 is paid.

**FREE EXAMINATION COUPON**

Name.....

Address.....

Occupation.....

Employed by.....

4734







# Could She Love Him Were He Bald?

**O**N what a slender thread hangs interest—  
Affection—*Love!*

She notices, for the first time, some tell-tale specks of dandruff on his coat, and that his hair is getting thin on top. What if he should lose it! Could she love him then—if he were bald—bald as Uncle Charley?

The very thought is a severe shock to her, for she has always been so proud of his personal appearance—and her own. Wherever they have gone together, the verdict of their friends has been, "What a good-looking couple."

But if he should lose his hair—if he had a shiny, bald head—she just couldn't stand it. Anything but that. She wouldn't mind a sweetheart or a husband whose hair was gray, or even one with a red head—but a bald head . . .

Could any girl's romance survive *that* blow?

## New Hair for You In 30 Days —Or No Cost!

Don't let thin, scanty hair ruin your personal appearance. It isn't necessary.

If you are worried over the condition of your hair

—if it is falling out

—if it is getting thin on top

—if your bald spot is growing larger every day

send at once for our free booklet, which gives you full particulars of an easy, simple home treatment that has grown new hair in one month's time for hundreds of people.

Don't say "It's too good to be true." Don't be skeptical. Don't doubt. Investigate. That's the only wise thing to do. It costs you nothing to find out what this treatment has done for others—what it can do for you.

So, mail the coupon now. Learn all about this marvelous, new treatment that produces such amazing results.

### Proof of Success

You are not asked to take our word in this important matter. We can refer you to hundreds of delighted people for whom we have grown new hair, after all other remedies failed. Read these brief extracts from a few of the hundreds of grateful letters, which are on file in our office, open to your personal inspection.

"The top of my head is almost covered with new hair. I have been trying for last five years, but never could find anything that could make hair grow until I used your treatment, and now my hair is coming back."—Tom Carson, Ohio.

"Hair stopped falling out and quite a lot of fine new hair is coming in where my head was bald. Can highly recommend it."—F. L. W., San Francisco, Cal.

"Lots of hair is growing where I was bald. It was just as bare as the palm of my hand. New hair is coming again."—C. Fitzgerald, New York.

"I have gained remarkable results. My scalp now is all full of fine new hair. I am well pleased with results."—A. W. B., Maywood, Ill.

"A new growth of hair has shown on each side of temple where I have been bald for years."—Chas. Barr, New York.

If you want just such results as these people are getting—if you want to stop your falling hair—cover up your bald spots—improve your personal appearance—let us hear from you at once.



### Free Booklet Tells All

All you need do to obtain full details of this easy, pleasant, home treatment, that grows new hair in thirty days or costs you nothing, is to sign and mail the coupon at the bottom of this page.

This interesting, 32-page booklet, not only fully explains our simple, scientific system of growing new hair, but it gives you positive proof of what we have done for others, together with photographs showing what can be accomplished.

Act promptly. The sooner you get this informative little book, the sooner you can stop your hair from falling out—start to cover up the bald spots—begin to improve your personal appearance.

ALLIED MERKE INSTITUTES, Inc., Dept. 174  
512 Fifth Avenue New York

ALLIED MERKE INSTITUTES, Inc.,  
Dept. 174, 512 Fifth Avenue, New York

You may send me, in plain wrapper without cost or obligation, a copy of your new booklet telling all about the Merke Institute Home Treatment for stopping hair from falling out, growing new hair and improving one's personal appearance.

Name, \_\_\_\_\_  
(State whether Mr., Mrs. or Miss)

Address, \_\_\_\_\_

City .. . . . State .. . . .





## "The Handiest Tool in my Workshop"

"YOU ought to get one of these handy Jorgensen Hand Screws for your tinkering, Bill. It saves a lot of time and trouble mending furniture, drilling radio panels, and dozens of other things I do around the house. But listen, Bill, don't get one of those old-fashioned hand screws with wood spindles. Be sure to get one of these Jorgensen 'steel spindle' Hand Screws. They don't break or warp, and you can hold things at an angle, too!"

"If the hardware dealer hasn't any of these Jorgensen Hand Screws, send for one or two by mail. I know all the big mechanics' supply houses sell them. It's easy to get them, either way. You better get busy, today, Bill, and write to the

### Adjustable Clamp Co.

Manufacturers of the  
**"JORGENSEN"**  
 STEEL SPINDLE HAND SCREWS  
 212 N. Jefferson Street, CHICAGO

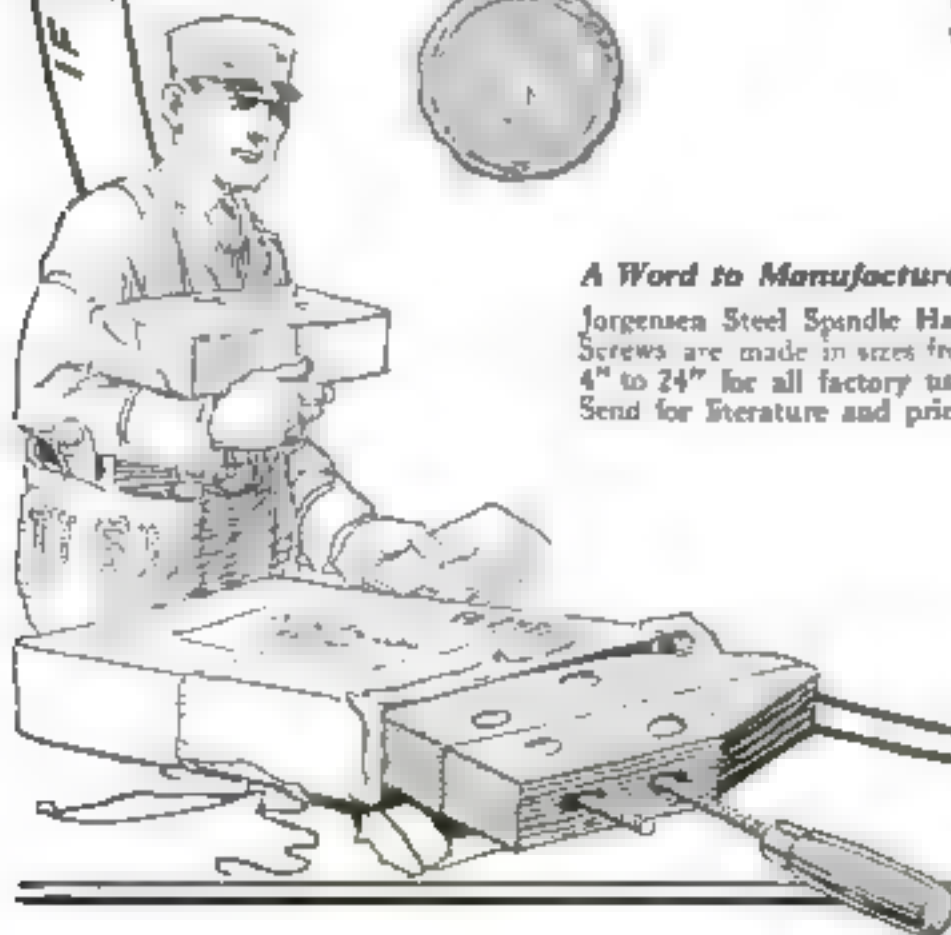
### A Few Uses

- Holding radio panels while drilling
- Clamping wood pieces while gluing them.
- Holding metal parts while soldering
- Using hand screws as a vice when sawing, etc.
- Holding templates while marking work

### A Word to Manufacturers

Jorgensen Steel Spindle Hand Screws are made in sizes from 4" to 24" for all factory uses. Send for literature and prices.

IF YOUR DEALER CANNOT SUPPLY-YOU MAIL THE COUPON



Adjustable Clamp Co.  
 212 N. Jefferson St., Chicago

Please read items checked below

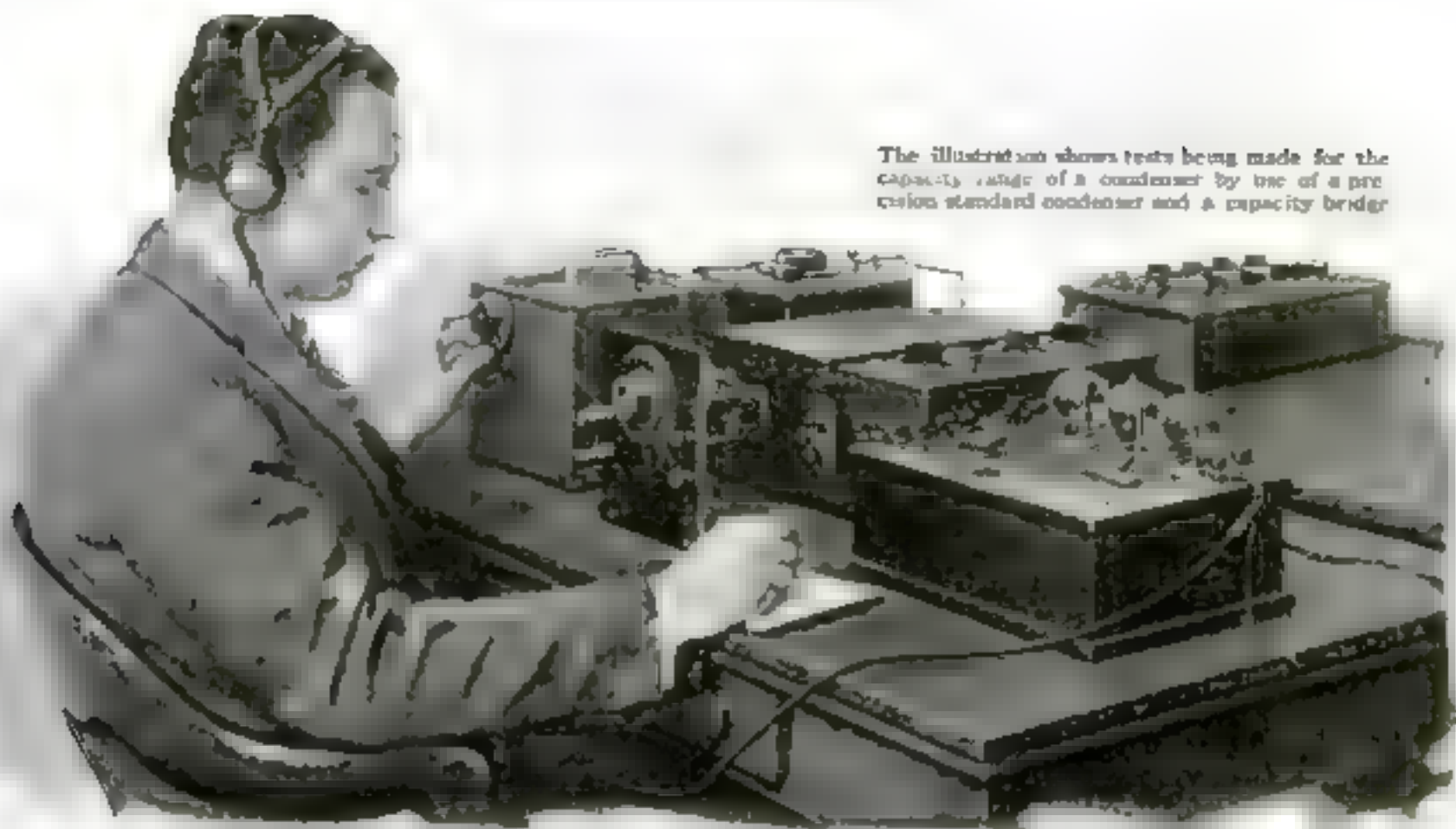
- ☐ Latest descriptive circular
- ☐ Ship by mail, postage prepaid, ONE No. 10 JORGENSEN Hand Screw, jaws 4" long, opening 2" for which I enclose \$1.00
- ☐ Ship by mail, postage prepaid, ONE No. 8 JORGENSEN Hand Screw, jaws 3" long, opening 1 1/2" for which I enclose 41 1/2

Money will be refunded if tools are not satisfactory and are returned in good condition in 10 days.

Name

Address





The illustration shows tests being made for the capacity range of a condenser by use of a precision standard condenser and a capacity bridge.

## The Institute Tests Variable Condensers

By Thomas Vanacore, B.S.

Assistant Radio Engineer

Popular Science Institute of Standards

**P**URCHASERS of condensers almost invariably specify that a "low-loss" condenser is desired. And they usually get a low-loss type of condenser—but it is not low loss in the commonly understood sense of the word.

This is a point that is stressed particularly by the Popular Science Institute of Standards. No condenser can be advertised in *POPULAR SCIENCE MONTHLY* as a "low-loss condenser" unless the tests made by the Institute have proved conclusively that the condenser actually is a low-loss condenser. Nor can any condenser, or other radio and tool product, be advertised in the columns of *POPULAR SCIENCE MONTHLY* unless they come up to the standards of the Popular Science Institute of Standards.

In the radio industry the term "low loss" has come to signify a certain type of condenser. If the construction of a particular condenser of this type follows along correct electrical design, the losses will be low. However, there are many condensers of this low-loss type whose losses are actually greater than in the case with the older type of condensers.

In our laboratory we determine the losses both at 1000 cycles and also at the usual radio frequencies. We measure these losses in terms of an equivalent series resistance and express the efficiency of the condenser on this basis in terms of its phase angle difference.

Therefore, a condenser that is sub-

mitted to the Popular Science Institute of Standards as a low-loss condenser must have a particularly low phase angle difference, in addition to the other Institute requirements.

In general, approval of condensers is based on the following points:

- 1—Quality of workmanship
- 2—Mechanical construction
- 3—Electrical efficiency

It is essential in a condenser that the insulating material be of good quality and properly placed if it is to give maximum efficiency. The contacts in a condenser must be positive, the bearings smooth

running, and the plates must be spaced accurately and clamped strongly. We also determine whether the dial be calibrated well, the rotary plates locked together and secured firmly to the shaft, and whether a counterweight is provided for the panel mounting types.

All variable condensers on the approved list of the Popular Science Institute of Standards have been proved by test to be of trouble-proof mechanical construction, high ratio of maximum to minimum capacity, low phase angle difference and high insulation resistance.

A precision standard condenser and a capacity bridge form the essential part of the equipment for making such tests. These are illustrated above.

Since the condenser plays such an important part in a radio receiving set, great care should be taken in its selection. In selecting a condenser from the approved list of the Institute, one may be certain that he is adding to the efficiency of his set.

It is obviously impractical for even an completely organized a bureau as the Institute of Standards to test all products listed in tool or radio catalogues advertised in our columns. Only tool and radio products specifically advertised in *POPULAR SCIENCE MONTHLY* are tested and approved by the Institute.

### Send for List of Approved Products

*POPULAR SCIENCE MONTHLY* will be glad to furnish a list of Radio and Tool Manufacturers whose products have been approved by THE INSTITUTE.

### POPULAR SCIENCE Monthly Guarantee

The above seal on an advertisement indicates that the products referred to have been approved after test by the Popular Science Institute of Standards.

Popular Science Monthly guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in *Popular Science Monthly* may expect that these products will give absolute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by Popular Science Monthly.

THE PUBLISHERS.







# THE GREBE

## SYNCHROPHASE

TRADE MARK

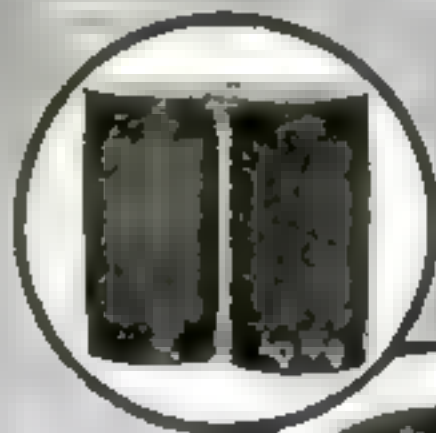
It is written

"If there be no faith in our words,  
of what use are they?"

It is easy to prove the claims  
made for the Synchrophase.

*Charles H. Hays*

No other receiver has  
these features:



Bimocular  
Coils

S-L-F  
Condensers



Volume  
Control

All Grebe apparatus  
is covered by patents  
granted and pending.



If you have once operated a Synchrophase you will not be satisfied with any other type of receiver, because Grebe exclusive and fundamental features provide reception that is unsurpassed.

Bimocular Coils, which keep the set balanced against local interference, provide greater selectivity and sensitivity.

S-L-F (straight line frequency) Condensers make tuning-in quick, easy and positive. All stations are spaced at equal intervals around the dials, short wave stations are not crowded onto the lower numbers.

Grebe Volume Control gives six gradations of sound without detuning or reducing tube current, thus maintaining the true character and shading of every note.

In sets made up of assembled parts, the assembler has no control over their design and quality. Therefore, every detail of the Synchrophase is designed and built in the Grebe factory. Thus, all parts coordinate perfectly. This makes possible the perfect performance of the Synchrophase.

This perfection extends also to the Synchrophase cabinet. It is beautifully designed and built of solid mahogany highly polished and with delicately embossed gold escutcheons.

Compare all sets before you buy, but be sure to have the Synchrophase demonstrated by your dealer.

Ask your dealer or write us for full information

**A. H. Grebe & Co., Inc.**

Van Wyck Blvd., Richmond Hill, N. Y.

Western Branch: 443 So. San Pedro St., Los Angeles, Cal.

This company owns and operates station WAHG



Synchrophase with  
battery base





# The Magic Stuff that Saved Nome

*How, in the Blood of Horses, Are Produced Invisible Conquerors of Human Disease*

By Edward Mott Woolley

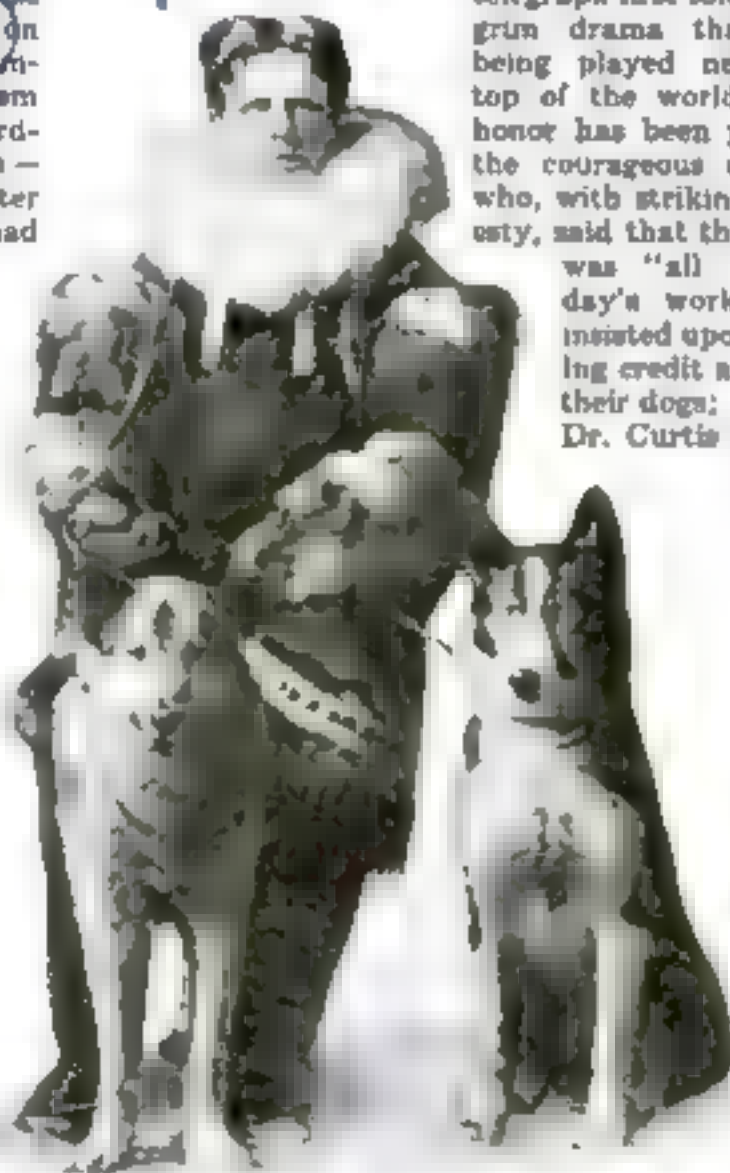
**A** NEW Epic of the North, greater by far than any from the master pens that have celebrated the Arctic, was written recently when seven relays of intrepid mushers, lashing their dog teams to unprecedented efforts, sped over the trackless Alaskan trails to carry life-saving antitoxin to the city of Nome, stricken by an epidemic of diphtheria, the famous "black death" of the North.

Fighting withering cold, fierce gales, and roaring blizzards, these Spartans of the snows urged on their fleet huskies to accomplish the 660-mile journey from Nenana to Nome in the record-breaking time of 27½ hours—approximately 5½ days—faster by far than dog sleds ever had traveled before, even in the "derbies"—races for generous prizes—in which the best Alaskan dog teams contest each year. Never did the purses and honors of those derbies prove such reason for pressing on to the very limits of human endurance as did the call of suffering humanity that seemed to ring in the ears of the drivers as they struggled over the snows.

Twenty-seven persons lay sick of the dread disease when Gunnar Kason and his 18 dogs pushed wearily into the settlement with the precious 20-pound package containing 300,000 units of the life-saving serum. Twenty-eight others had developed what appeared to be symptoms of the scourge while Kason, and Leonard Seppala, most famous of all Alaskan sled drivers, and Tom Green, and Shannon, and Nicolai

and the others were carrying the needed serum over the snowswept trails. A frightful list of patients, this, in a community with a population of between only 600 and 800 souls. Compute the same proportion of disease cases in a city of a million, and you will appreciate how critical the situation was.

The eyes of the whole world have been turned toward the little settlement on the fringe of the Arctic Circle ever since the telegraph first told of the grim drama that was being played near the top of the world. All honor has been paid to the courageous drivers, who, with striking modesty, said that their feat was "all in the day's work" and insisted upon passing credit along to their dogs; also to Dr. Curtis Welch,



**Heroes in the Race with Death**

Leonard Seppala, champion musher of Alaska, with two of his famous lead dogs. In the face of a raging blizzard they sped over 245 miles of trackless snow in the longest of seven dog-died relays that carried 300,000 precious units of diphtheria antitoxin to plague-stricken Nome. All Alaska speed records were broken.



**Germs to Fight Germs**

Inspecting the growth of bacteria in laboratory cultures. The killed bacteria, injected into the blood of animals, arouse the life cells to produce the disease-fighting antibodies that are contained in the antitoxin serum.

of the U. S. Public Health Association, who, with the assistance of a single nurse, battled ceaselessly with the hosts of death before the antitoxin arrived.

But there are other men—other animals, too—deserving of credit for the parts they played in that thrilling episode. They did not face the rigors of the Alaskan winter, nor dare death under circumstances so dramatic that the attention of the world was focused on them. Yet in their own way they served, and served well, for it was they who produced the magical stuff—the antitoxin—without which the heroic efforts of the Alaskan sled drivers would have been in vain.

**I**T IS a fascinating story, this tale of the efforts of science to end the ravages of diphtheria, pneumonia, typhoid fever, spinal meningitis, erysipelas, lockjaw and the other deadly maladies of humankind through the production of what scientists call "bacteria antibodies," or "immune serum," which are Nature's weapons against the germs of disease.

All around us continually lurk whole armies of invisible enemies of human life, inhabiting that vast and mysterious underworld we call disease, and watching always for a chance to gain ingress to our bodies. We speak of these microscopical despoilers as bacteria, which by the use of a little imaginative license we may endow with attributes of crafty intelligence, ever



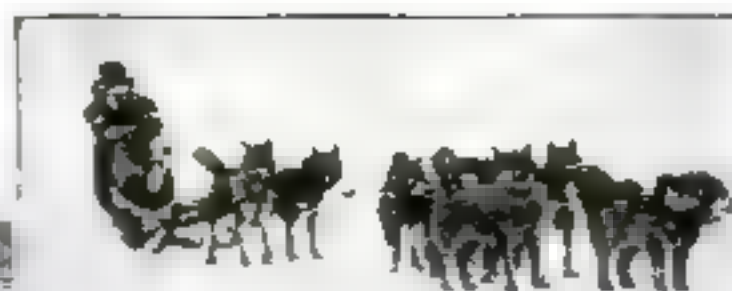
eager for the deadly contact with human kind that will give them entrance to the blood stream through mucous membranes, pores, or skin abrasions, or, with greater cunning, by way of the hair follicles.

**BACTERIA**, indeed, would speedily destroy us and wipe out human and animal life except for a mystifying force within ourselves known as "natural immunity." This is a wonderfully fascinating subject, about which little was known until comparatively recent times. But when biologists began to unlock the secrets of natural immunity they not only revealed a new and unsuspected world, but discovered strange possibilities for the treatment of disease.

They found that natural immunity was a tangible force, lying largely in the

### The Rescue Trail at Nome

From Anchorage the 36-pound package of life-giving serum was carried by rail 300 miles to Nenana. The remaining 650 miles to Nome were accomplished by dog teams in 5 1/2 days.



### Ursung Hero

Training and  
the hero of the  
story is a  
dog named  
Nutmeg.

ability of the body cells to produce antitoxins and other substances with which to meet the attacking enemy bacteria. These discoveries were pivoted on studies of the body cells.

Without going far into the realms of fancy, we can say that every human cell is virtually an animal in itself, and that the human being is made up of vast numbers of these animal cells. Some of them are working to build and maintain the body. Others, known as the "white cells" or "leucocytes," or sometimes "phagocytes," are wandering cells, with power to elopate and propel themselves from one point of the body to another, passing through the tissues with a peculiarly penetrating power. The phagocytes are among the chief fighters of disease germs, which they devour. With a powerful microscope they can be seen in motion, carrying fragments of bacteria.

To accomplish the overthrow of the bacteria and reduce them to a form in which they can be digested by the phagocytes, the body cells produce and throw off into the blood a mysterious something, possibly chemical substances,



### A Magic Weapon Against Plague

This little bottle contains 10,000 units of diphtheria antitoxin, sufficient for one treatment. Thirty times this amount was carried in the dramatic dash over the snow to Nome, where 27 persons lay sick of the dread disease.

which scientists call "antibodies." These antibodies never have been identified as visible entities. Just what they are remains to be discovered; but although they never have been seen, their presence or absence can be ascertained positively. Just what antibodies will do is known to a certainty. Every different form of disease, moreover, is combated by its particular antibody in the blood.

Every person in normal health has enough antibodies in his system to destroy a reasonable quantity of almost any sort of bacteria. This is natural immunity. When an unusually large quantity of especially virulent type of bacteria gains access, or when the subject is weakened or even temporarily exhausted, the natural immunity is overcome and disease gets the mastery.

**SO SCIENCE**, as represented in the fields of medicine, bacteriology, and biology, has discovered by extraordinary means how to produce antibodies artificially in the blood of horses or other animals and how to separate and purify the serum containing the antibodies after it is drawn from the blood stream of the animals, making it safe for injection into the blood of persons suffering from infectious diseases.

At Glenoben, Pa., not far from Philadelphia, I saw recently a herd of wonderful horses, which are devoting their lives to growing in their blood these mysteriously invisible, yet tremendously real antibodies. These horses haul no drays and drag no plows, but live in equine luxury, protected by every sanitary device, fed on the choicest of stable provender, groomed and petted and exercised as the aristocratic horse should be; all because their blood streams are the garden soil of science. Without suffering or inconvenience they produce, through nature's own miracle, the very substances





Leonard Seppala and his Siberian huskies which bore him  
brunt in Alaska's most dramatic race against death.  
Togo, Seppala's famous lead dog, was lost on the journey.

that we ourselves produce in our own blood, in normal health, to crush or poison invading microbes of death.

These horses receive at first minute hypodermic injections of killed bacterial cultures or their poisons. This immediately arouses the animal cells to produce antibodies. Gradually the doses are increased, and at last the horses are painlessly bled. The serum is refined, tested for purity, safety and activity, and then bottled.

**IT WAS** these very horses that supplied most of the antitoxin rushed over the snows to relieve disease-infested Nome.

It was these very horses that, only a few months earlier, supplied the serum that checked the outbreak on the Pacific Coast of the now rare pneumonic plague, the black death that killed millions of people in the fourteenth century.

In the foreign section of Los Angeles a woman died from a strange and galloping disease, and of those who attended her funeral, nearly all met with a similar fate. Los Angeles turned to medical science for the identity of the dread invading germs, and the answer was quick and positive.

Rare though this diabolical disease has become in modern times, the biological laboratory in Philadelphia, which I have mentioned previously, had an anti-plague serum actually in stock, awaiting the possible call of emergency. Within an hour after the transcontinental telephone brought word to the laboratory of Los Angeles' need, 500 doses of the serum were packed, and an automobile was off for a flying-field near New York. Speed records were broken, and the air mail carried the only known remedy to the Western Coast in a couple of days. As a result, the invisible enemy was put to rout. The quarantine was raised in a few weeks, with the death count less than 40.

**THRILLING** incidents such as this, and the more recent race with death across the Alaskan snows, of course are infrequent in the war that science is waging against destructive bacteria. Yet it is such a gigantic struggle that its underlying dramatic elements are unescapable.

It is a wonderful warfare, according to Milton Campbell, president of the H. K. Mulford Company, of Philadelphia, to whom I am indebted for most of the material contained in this article. All its forces are directed along ultra-scientific lines, for the saving of human lives. It deals not only with the sick—those actually in the grip of bacteria—but with the protection of millions of persons still

uninfected but moving among the hazards of disease.

The scientific prevention of disease is revolutionizing medicine. Medical men of today are generally agreed that the physician of the future will devote a large share of his skill toward the prevention of infectious diseases, not alone by sanitation, but by actual immunizing of his patients.

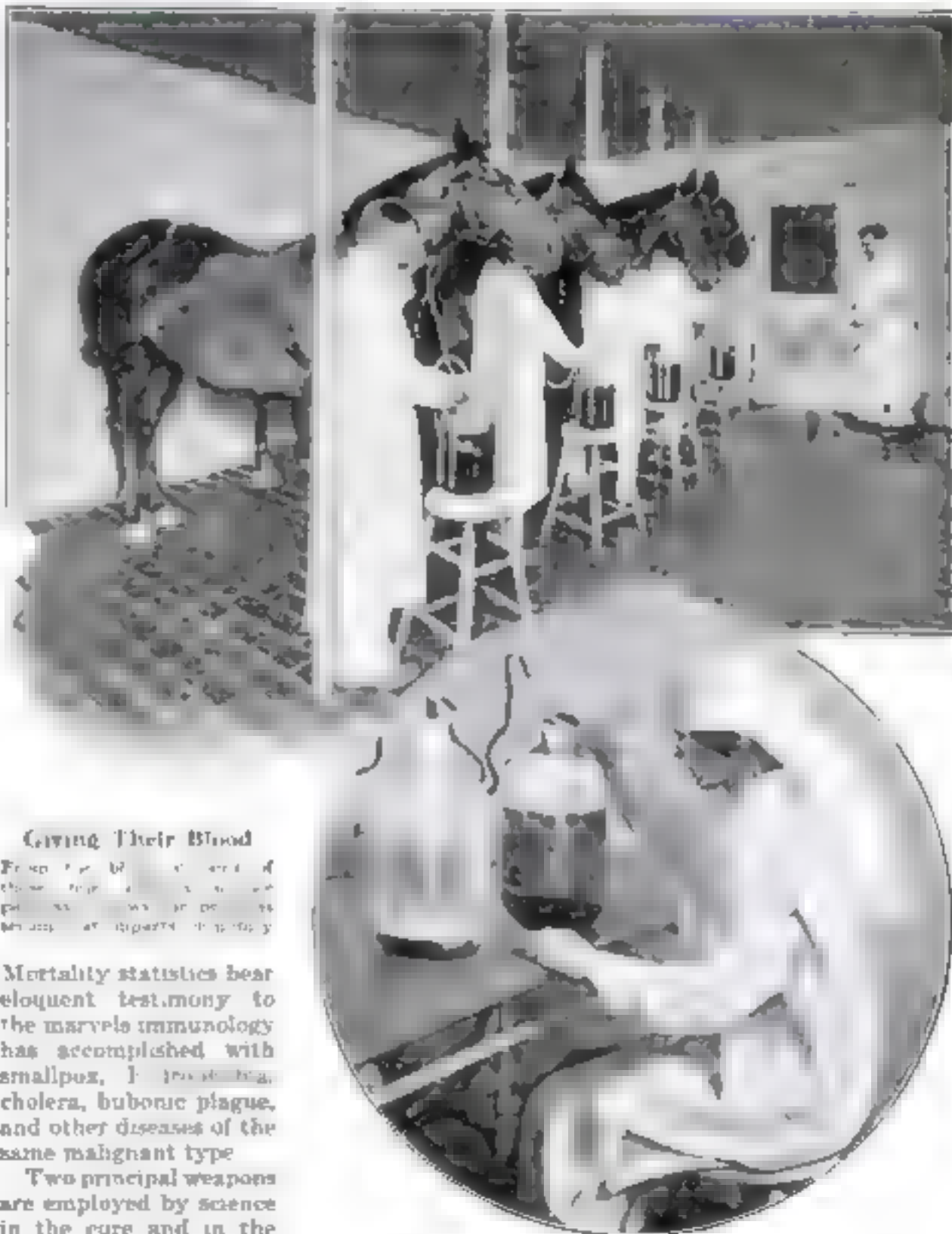
Compare the present and past history of disease and you will be struck by the progress being made in immunology.

is a solution containing the germs themselves, killed; while a serum is obtained from the blood of horses or other animals containing the antibodies produced artificially. It was found that killed bacteria, when injected into man or animals, would arouse the antagonism of the body cells, much as the live bacteria would do, and that the cells would proceed to generate antibodies.

Going a step further, the research scientist made another great discovery—serobacterins, a product containing both antibodies and killed bacteria. The ready-made antibodies attack the disease that afflicts the patient, while the killed bacteria stimulate the cells to produce natural antibodies.

**WHATEVER** the nature of the virus, whether it be the microbe of plague, dysentery, cholera, typhoid, the virus of rabies, or the toxin of diphtheria, or whether the microbes are killed or living, this process, known as sensitization, confers on them properties that

(Continued on page 34)



Giving Their Blood

From the blood of these horses, serum is obtained, which is used to treat the sick.

Mortality statistics bear eloquent testimony to the marvels immunology has accomplished with smallpox, typhoid, cholera, bubonic plague, and other diseases of the same malignant type.

Two principal weapons are employed by science in the cure and in the prevention of disease by immunology—bacterins and serums. A bacterin

Then, in the laboratory, the serum is separated from the red blood corpuscles and purified to make it safe for injection into the blood of persons, there to crush invading microbes of death.





Secure from disaster—How the ingenious airplane-parachute might appear in flight, and as unfolded into a huge umbrella with wings and motors released, floating safely to earth. Contrast with the plane crashing in flames in the background.

# Amazing Plane Its Own Parachute

**I**MAGINE, for a moment, that you are seated in a great passenger airplane, riding across the sky thousands of feet above the earth.

Suddenly comes a sharp explosion. The machine dives dizzily. A moment or two more, you think, and it will be the end.

But at the instant the thought of certain disaster flashes across your mind, the pilot pulls a lever and, to your amazement, the wings, motors, gasoline tanks, and propellers fall away from the streamlined fuselage. Simultaneously, as the wingless car plunges in a nose dive, the rounded sides of the fuselage itself begin to open outward in segments, like orange wedges. In the rush of air, these segments, joined by webs of strong canvas, and all hinged to a center shaft at the rear, quickly open wide to form a gigantic umbrella.

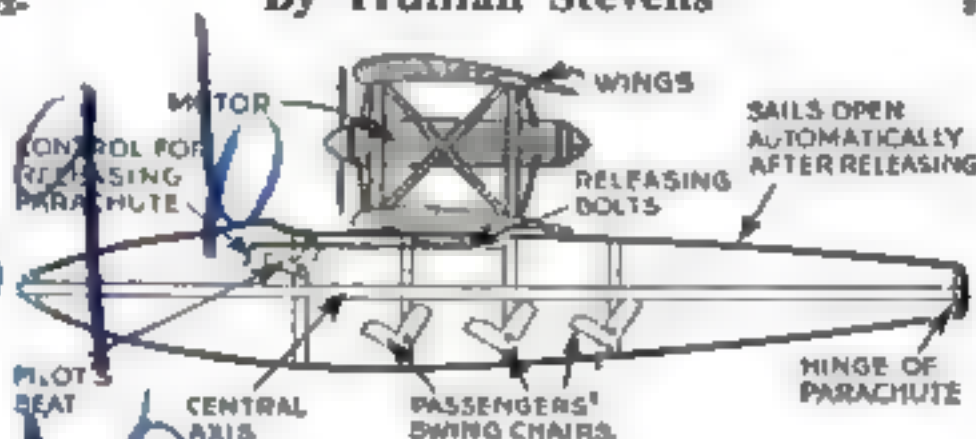
**I**NSTEAD of crashing to almost certain death, you find that you are still riding easily in the same comfortable chair. The breathless plunge downward has ceased. Now you are floating earthward gently under the dome of a giant parachute.

Just such a combination airplane and parachute, amazing in its conception, yet astonishingly simple in design, is the recent invention of Captain Lepinte, a French aviator, who has gained distinction for the production of several other safety devices for airplanes.

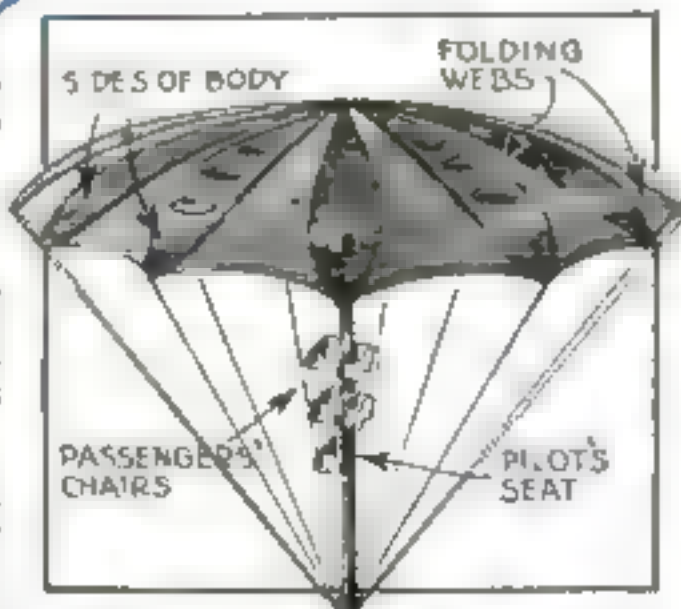
Stripped of its superstructure, the flying machine is an immense folded parachute in itself.

*In Emergency the Wings Drop off and the Body Unfolds*

By Truman Stevens



Design of the machine. The shaded portion represents the wings, power plant and gasoline tanks, all released by a control lever in the pilot's cockpit. The same lever simultaneously releases the parachute.



How the sides of the airplane body, joined by canvas webs, open to form the parachute. Notice how the passengers' seats, pivoted on the center shaft, swing automatically to an upright position as the nose of the machine points downward after the parachute is freed.

The secret that lends practicability to the invention lies in the manner in which the separable parts are held together so that they can be released almost instantly. The fastenings are screws with interrupted threads, which may be locked together or unlocked simply by one-eighth turn of the screw. The entire mechanism for releasing all the various fastenings is controlled by the pilot in a single operation.

**T**HUS, simply by swinging the handle of a lever, the pilot can separate the wings, motors, and propellers from the fuselage. The same movement releases the segments of the

fuselage covering that open outward to form the parachute. The complete release requires not more than a few seconds. To prevent the big umbrella from turning inside out, wire stay ropes connect the outer rim of the parachute with the nose end of the center shaft. Danger of the plane's catching fire after an accident in the air would be obviated by the release of the fuel tanks.

An interesting feature of Captain Lepinte's invention is the manner in which he provides that the passengers shall remain seated upright in their chairs even when the nose of the car is pointed downward. He has designed the seats so that they are attached by pivots to the center shaft of the fuselage. Thus, whatever angle the fuselage takes, the chairs always swing to an upright position.

Captain Lepinte estimates that the car would descend with a velocity of not more than nine feet a second.



# Airplanes Hurlled to Bits in Test

## Terrific Crashes Against Wall Show Faults

By Newton Burke

**W**ITH crashes that echoed through the surrounding country for miles, four airplanes recently were hurled to destruction down an incline and against a concrete wall at Wilbur Wright Field, Dayton, Ohio, in a spectacular test conducted by Army Air Service engineers to ascertain the principal structural weaknesses of aircraft and to determine the causes of airplane collapse, as well as explosions and fires in fallen planes.

The four planes selected for the test were old and of obsolete models. The wings were removed to prevent the planes from rising. The machines were sent away separately from a concrete platform 25 feet high, from which an inclined track led to a concrete wall 100 feet away. Each plane was lashed to the track, and its main gasoline tank and the gravity tank on top of the fuselage were filled with 100 gallons of gas. Then the motor was started, the throttle was thrown wide open, and the rope that held the craft cut with an ax.

Immediately the plane plunged forward. Gathering momentum with each revolution of its propeller, it attained a speed of more than 100 miles an hour before it reached the bottom of the incline. The crash heard as each plane in turn struck the thick wall of concrete was terrific. Bits of wood and metal were cast high in the air. In one case a small diver from a propeller rose 200 feet in the air and fell 100 feet away. A spray of gasoline drenched photographers and en-



Headed for Destruction—One of the four pilotless test planes at the top of the incline, just before plunging downward and crashing into the concrete wall seen in the distance.

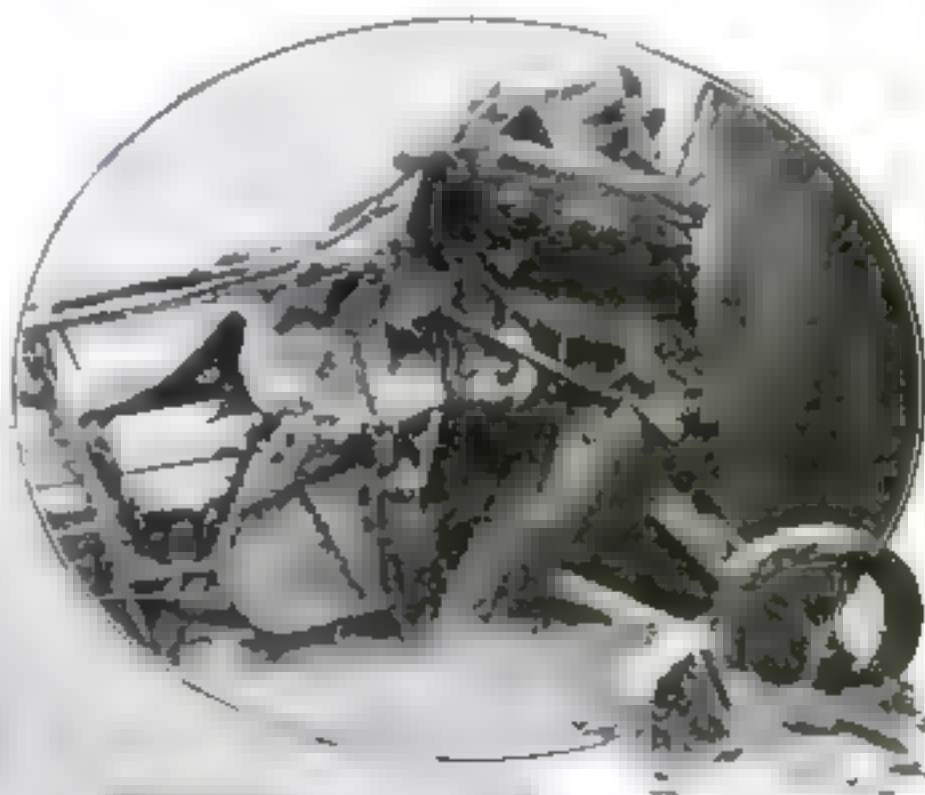
gineers who were watching the demonstration from shelters 25 feet away.

In each case the propeller shaft embedded itself in the concrete to a depth of about a foot. The steel propeller was reduced to splinters. Each plane rebounded slightly from the wall, then crumpled into a shapeless and shattered mass of metal.

In one respect the test failed of its purpose—no plane caught fire or exploded. Army engineers stated afterward that the cause of failure and explosion in planes that have crashed to earth is highly mysterious. Usually, though, it is the fuel tank that explodes.

Crashing in this position causes the entire structure to be deluged with gasoline, thus readily starting a fire if sparks occur. This method of descent was not reproduced in the tests, the runway down which the planes sped being inclined at a comparatively small angle.

The army engineers are not yet ready to announce the results of the tests regarding structural weakness of aircraft.



The Crash—and What Was Left

In the test, the impact between the plane and the wall caused a wall of splinters of wood and metal to be hurled against the air. A thick mist of gasoline descended from the plane's fuel tank, which was a remarkable phenomenon at the time. The nature of the crash was less violent. The plane rebounded slightly and crumpled into the shapeless mass of metal shown above.





# The TAMING

How this terrible giant has  
It lifts huge mountains and

*By Robert*

innocent looking, as thick as two fingers, and a few inches long. They look like compressed sawdust, stuck together with molasses, maybe.

Why the sticks should be put in the ground in such a way might not be apparent to the casual observer; but presently there came a quick staccato

noise, as if a row of soldiers in some hidden trench had fired their guns almost in unison. Along that straight line where the sticks of dynamite had been, a great upheaval of dirt rose perhaps 10 or 15 feet, falling in dusty shower.

And then, when the cloud had settled, there was revealed something almost magical. Where the line that marked the dynamite had been lay a ditch, four or five feet deep and wider than that at the top—a drainage channel almost as neatly dug as if a hundred laborers had toiled for days with picks and shovels.

Long-time research work has made it possible within the last year to do things of this sort, along highly specialized lines. Scores of scientifically trained men spend their lives prying out of science explosives of kinder disposition but of greater capacity.

To learn something about these men and their work, I went to the experimental station of E. I. Du Pont de Nemours & Company near Wilmington, Del., and there Dr. C. M. Stine, Director

of Chemical Research, showed me some of the magic that modern research has wrought in taming high explosives for the every-day uses of man. He showed me how amazingly the giant dynamite has been harnessed to save time and labor.

"Vast improvements have been made in commercial explosives within the last 20 years," Doctor Stine told me when I referred to the ditch-digging job I had witnessed.

"YOU may think that dynamite works fast in this sort of excavation," he said, "but relatively the time required for the wave of explosion to run along the line of the ditch is long—maybe a good fraction of a second."

"The control of the speed of explosion is an important phase of the work with dynamite. It may seem grotesque to say that dynamite may be slow or fast. But apparatus has been devised for measuring the rapidity of explosion where the velocity is three or four miles a second."

"To the every-day spectator the whole



**Blasting a River Channel—A Man-Made Geyser**

Dynamite now can be put to work in water as well as in earth or rock. This spectacular photograph shows how tons of water were hurled a hundred feet in the air during the blasting of a channel in Cotee River, near Fort Richey, Fla. The completed channel, 10 feet wide and seven feet deep, connects the Cotee River for navigation with the Gulf of Mexico.

**S**EVENTY thousand pounds of dynamite—enough to blow up New York City if carefully placed—went off one day down in the mountains of Virginia. With the touch of an electric button a mile or two away, the detonating spark darted with incredible speed through hundreds of auger-like borings in the vast pile of rock and earth, touching the metal caps embedded in thousands of dynamite sticks. With a single impulse these chemical contrivances let loose their titanic force, lifting the whole mountain from its base and toppling it over into a deep gorge adjacent.

Thus the mountain, upside down, formed the foundation for a great dam—a structure that would have required enormous masonry work otherwise, far down in the depths of the canyon.

On the lowlands not far from this somersaulted mountain, I stood the other day and watched a crew of men place dozens of dynamite sticks in the ground in a straight line, perhaps six or eight feet apart. Dynamite sticks are round and



**How Dynamite Cut Off a Chimney Top**

Clipping a five-ton section from the top of a steel stack at Gibbetown, N. J., was accomplished recently with dynamite almost as

neatly as if it had been sawed off. The upper picture shows the falling section in mid-air. Below: How it looked when it struck the earth.



# of DYNAMITE

been put to work for us—  
cuts wood into stove lengths

## Bracefield

series of explosions seems almost simultaneous. To the research chemist, however, the difference in speed is of great importance. He can quicken the wave or slow it down as he pleases."

Doctor Stine described recent progress in removing the danger of handling high explosives in large quantities, citing the fact that in New York State is a seven-mile ditch dug cooperatively by farmers with dynamite.

"IN THE old days," he reflected, "you recall reading of the laborer who exterminated himself while thawing dynamite. The elimination of the necessity for thawing, through the production of a non-freezing dynamite, is one illustration of the work the scientist has accomplished. In the iron-ore country, non-freezing dynamite now is used at 30 degrees below zero."

Out on the highways of the Rockies next month, automobiles will get through with ease, where in former years motor traffic was often impossible before June, or even July. The modern method of opening such roads is to burst into the dense mass of ice and snow and break it up—with dynamite.

In the same manner ice jams in the rivers are blasted. In northern New York State not long ago a huge mass of ice formed above a large paper mill, and the impounded waters menaced the plant. Dynamite was shipped in response to a telegram, and the ice was dislodged in a day.

Quite as spectacular is the busting of log jams that not only threaten to flood whole regions.

but prevent the logs from floating to the sawmills. Here again dynamite comes to the rescue. It always lets loose the barricade.

In ordinary wrecking jobs, too, dynamite now does, in a few seconds, the work that formerly required days. In a college town, not long ago, a towering old brick smokestack alone remained of an erstwhile factory. For years it had disfigured the college settings. At last the contract was let to have it taken down brick by brick—but a dynamite contractor offered to remove it at a small fraction of the price involved by the other method. Beginning with small charges near the base and gradually enlarging the opening, he felled the huge chimney as accurately as the woodsman fells a tree, along a given



Testing Explosives

This latest apparatus shows as a horizontal distance for testing the relative nature of the explosive force of dynamite.



Safe to Handle

More than a stick of dynamite is a safe to handle. As a matter of fact, experts can cut it, scrape it, burn it, and even drop it without its exploding. Thousands of tons of it are transported every year by railroad, wagon and motor-truck.

line. So close was the reckoning that it had to graze one of the college buildings in its descent.

Quite kindly is the dynamite that cuts from the hillside slices of white or polychrome marble. Once upon a time the individual workman quarried these slabs with infinite labor. But now small charges of dynamite are inserted along an indicated line and exploded simultaneously, with a gentle dynamic tap. Yet it cuts out the slabs as neatly as the old-time quarryman could do it.

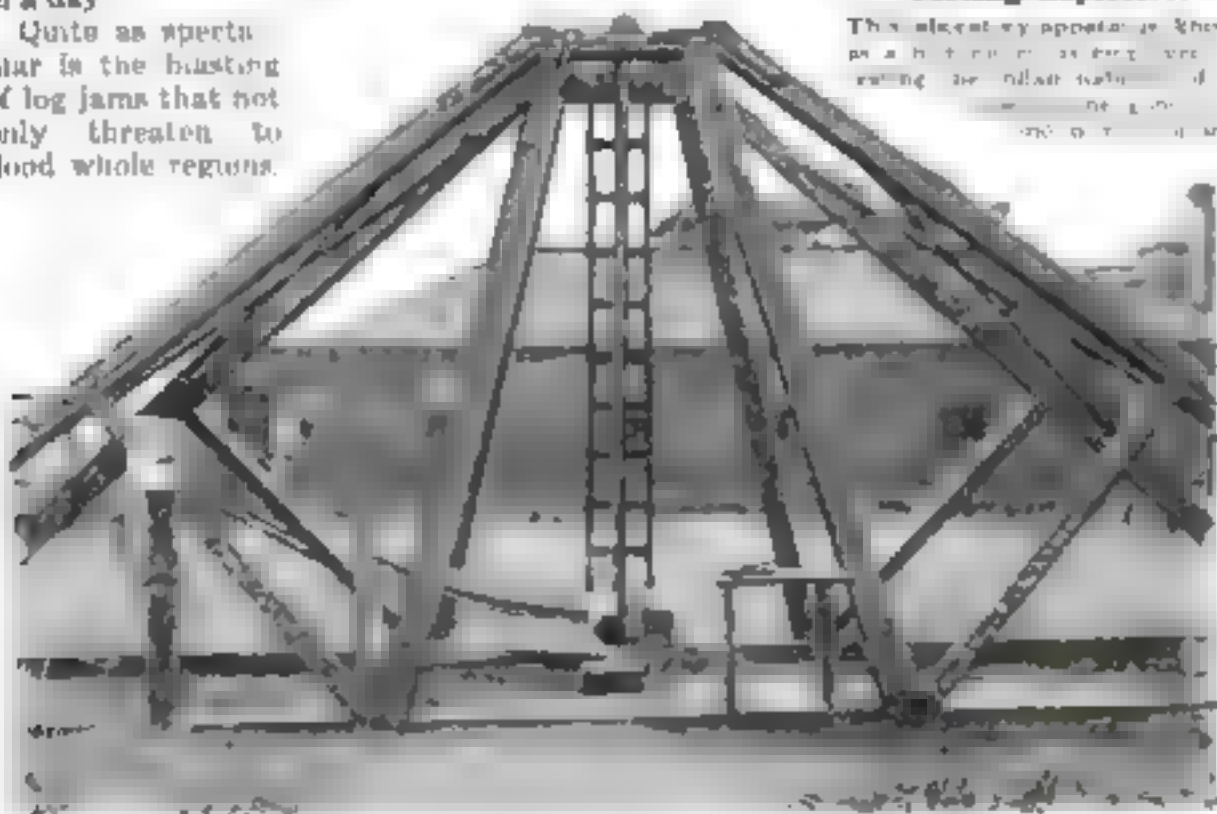
Almost benign also is the dynamite used for tree planting.

"On one occasion," Doctor Stine told me, "a group of women gathered for this purpose, and not knowing that dynamite was to be used they stood about the workmen as the sticks of explosive were cut in pieces. They began to inquire what the stuff was, and fled in disorder when they found out."

"WHEN the dynamite was placed in the hard soil and exploded, there was just a murmur and a tiny upheaval of earth over each charge. But the soil was loosened far down into the ground. Not only was the planting accomplished with ease, but the young roots had every chance to grow easily."

"This particular use of dynamite has become widespread, in the setting out of orchards, for example. Moreover, extraordinary results are on record where orchards had practically ceased bearing and were rejuvenated through the loosening of the soil with dynamite."

"Dynamite is an adjunct of farming in cut-over regions, where whole fields are freed from stumps in a few days. Contractors go even further and split the wood



How the Force of Dynamite Is Measured

Another testing apparatus, the ballistic pendulum, measures the explosive force of dynamite. The percussion is made to act against the ball

of a pendulum, causing the pendulum to vibrate. The amount of vibration then is measured on a calibrated arc, registering the force expended











# Newest Weapons for Fire Fighters

## French Motor-Car Engine Pumps 24 Streams of Water



### All from One Engine

This spectacular photograph shows how good French firemen stand up to the toughest fighting conditions. Twenty-four streams of water are being pumped from the Seine River by the motor-car engine which is mounted at the bottom of the ladder. For a class of firemen the most efficient fire-fighting system



### Protected from Smoke

French firemen are equipped with special masks which protect them from smoke and gas. The mask is connected to the engine by a hose.

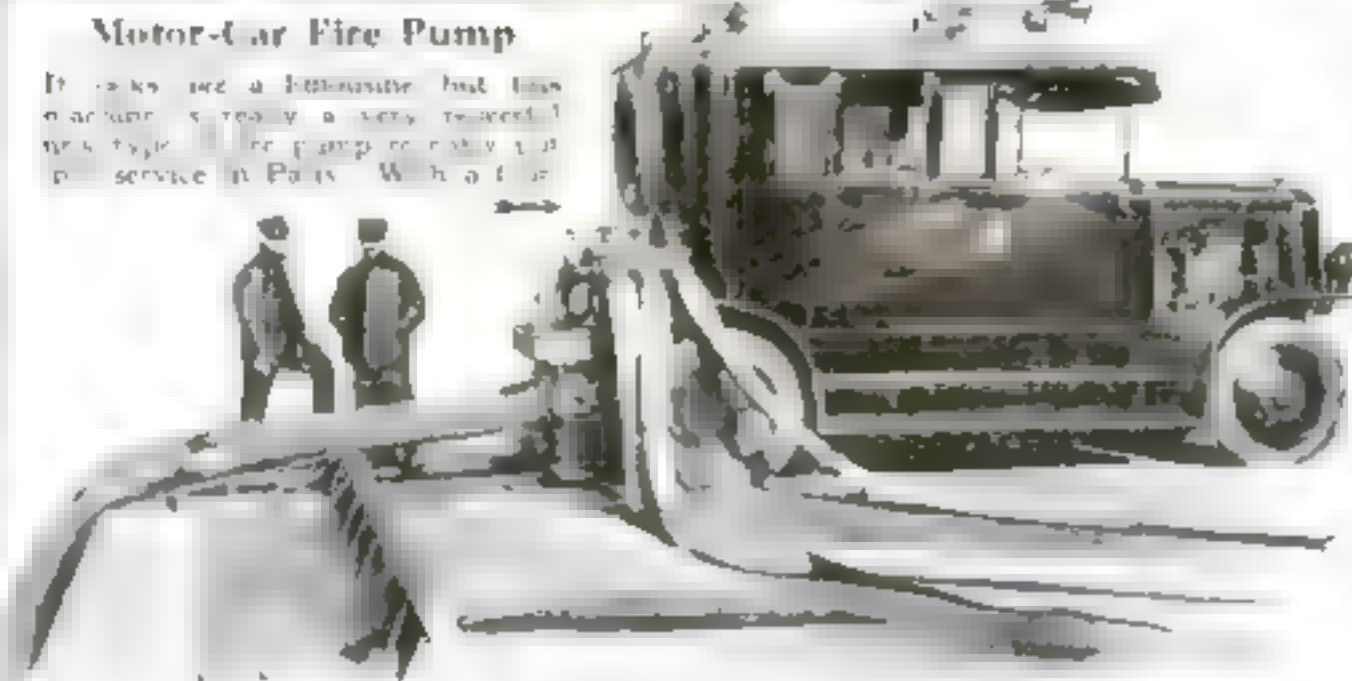


### Trailer Pump

An extremely light and portable pump is mounted on a trailer. It is used for pumping water from a fire hydrant to a fire engine. The pump is connected to the engine by a hose.

### Motor-Car Fire Pump

It looks like a little motor car, but this machine is really a very powerful pump. It is used for pumping water from a fire hydrant to a fire engine. The pump is connected to the engine by a hose.



### A Dizzy Climb

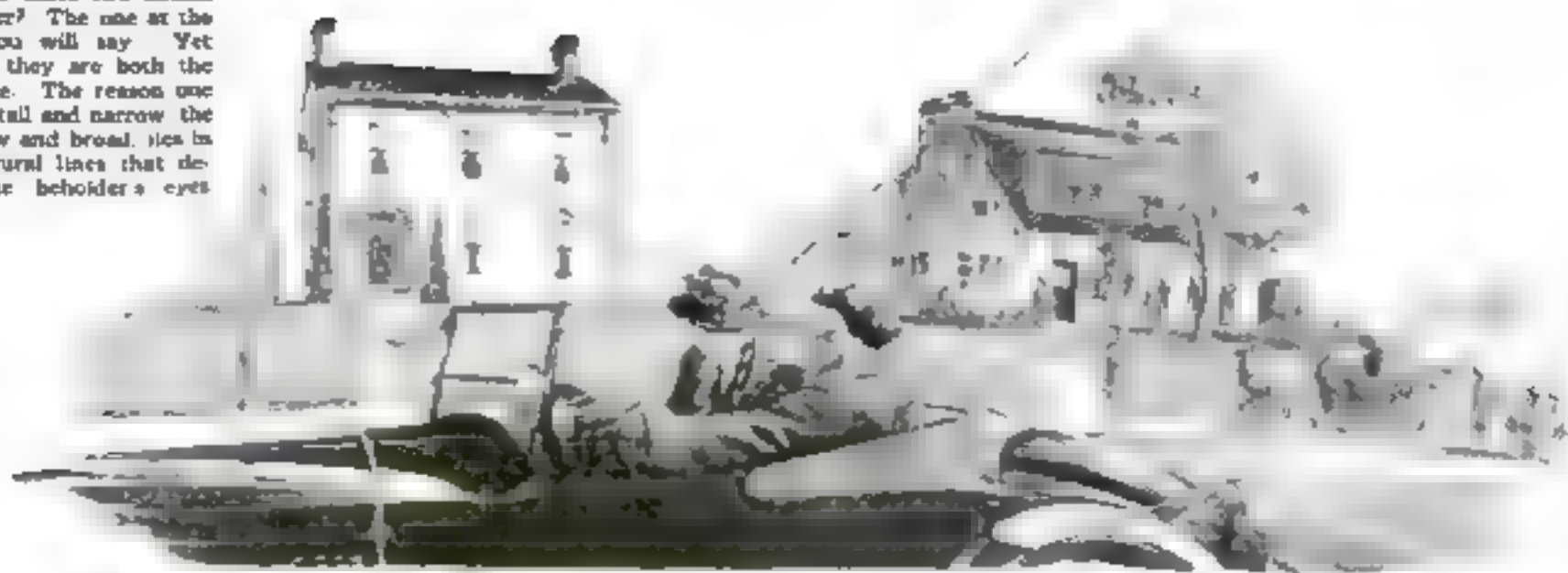
Among the most important pieces of modern fire equipment especially in large cities with tall buildings are the extension ladders. This one, in Paris, rises to a height of nearly 100 feet. This view shows French firemen in action

cylinder engine it is capable of delivering 24 high-pressure streams of water. The water is pumped from the Seine River through

the large hose seen at the left of the picture. Notice the battery of hydrants at rear of car, to which the fire hoses are attached



Which of these two houses is broader? The one at the right, you will say. Yet actually they are both the same size. The reason one appears tall and narrow the other low and broad, lies in architectural lines that deceive the beholder's eyes.



# Do Your Eyes Tell You Lies?

How the tricks of vision can be used to make fat people look slimmer, big feet appear smaller, or to make your home and its rooms more attractive—Try these tests on yourself and see how your eyes can fool you

By Alon Bement

A FRIEND of mine, riding in the country with me the other day, was remarking on two houses set fairly close together by the roadside.

"I wonder," he said, "why the builders didn't make that first house low and broad like the second. See how tall and 'stiff' it looks."

I looked at the two houses and replied:

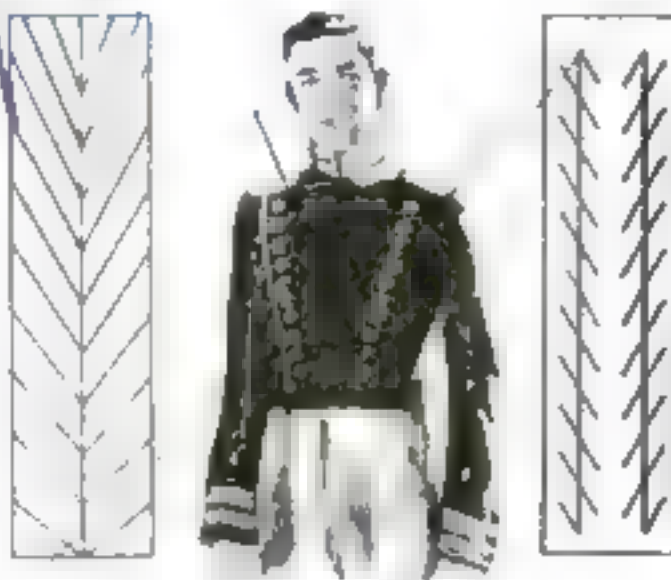
"Those houses," I replied, "are identical in size. The difference lies in the eaves, the windows, the chimneys, and the small extension."

Of course he didn't believe me. I actually had to get out and prove to him by rough measurements made across the lot fronts that the houses were the same. It did seem impossible that putting half a dozen low shrubs around a house and cutting an extra sized window (so as to make your eyes run sideways to take in all the windows instead of having them appear as spots) and lengthening the eaves could make a stiff, prim house look so broad and cozy.

But I had studied how to trick the eye and I knew how easily it could be done. I had seen many curious principles put into practice in marine camouflage, principles that we never could have made work if the eye were not fairly easy to deceive. The fact is, the eye can be tricked much more easily and much more completely than the ear, perhaps because the organs of hearing develop earlier than those of sight.

When we are frightened, we instinctively stop and listen. In the dark your eyes are practically useless, but your ear keeps on working just the same. Even while you are asleep your ear keeps guard, a little drowsily perhaps, but awake enough to give you warning before any other sense will. Therefore, within the

Professor Bement, a young American artist, is one of the world's foremost authorities on optical illusions. During the war he worked for the government in camouflaging American ships. He is now director of the School of Fine and Applied Arts of the Maryland Institute, Baltimore.



How Diagonal Lines Deceive

Fig. 1—Diagonal lines running upward make the rectangle at the left appear to taper toward the top. The perpendicular lines in the right-hand figure seem to converge toward the top. Yet actually they are parallel. The same principle is applied in uniform to make the hips of the wearer appear narrower and, by force of comparison, his shoulders broader.

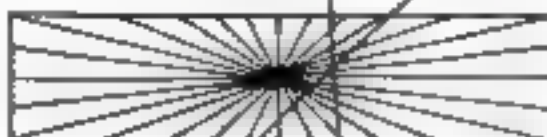


Fig. 2—Does the border of this rectangle look straight or curved? Here again the trick of diagonal lines makes the rectangle appear to bulge at the center and taper at the ends. Yet the outside lines are parallel.

range of its proper functions, the ear is considerably more to be depended upon than the eye.

We often are not conscious of the defects of the eye until we begin to consider the matter seriously, but at a very early age we have learned to interpret the illusions that confront us almost without thinking about them.

During the war, one of the earliest discoveries that we made was that we could reduce the visibility of objects on the land by painting them to resemble the objects about them, but when we tried to do the same with ships, we found that it wouldn't work.

The submarines had only to get the ship between it and the sun, and there you were—outlines as clear as anything. Besides that, the atmospheric conditions of the sea change so often and so greatly that you couldn't count on any given condition. You'd paint your vessel to be invisible in a green sea and the ocean would turn gray or purple.

AS IT didn't work, we had to try something else. The next time we went to the opposite extreme. We wanted the ships seen—the more vividly the better. The reason for this was that the submarines did not attack from a distance. When a submarine sighted a vessel, it remained on the surface long enough to get the size of the ship and her exact course, and having made its calculation on where the ship would be in 15 minutes, it submerged and headed under water for the place from which it could attack at close quarters.

We discovered that we could throw out the calculations of submarine pilots by deceiving them as to the direction the ship was taking. When we found that we



could conceal the true perspective of a vessel by the way we used lines, spots, and colors, we wanted the lines, spots, and colors to show up as brightly as possible. The submarine judged the course of a ship by its perspective lines. Wherever possible we distorted these lines; we pinched together or widened the natural lines at the bow or the stern, or made wide marks across them, so as to conceal the true shape of the ship and thus in the end make its speed and course difficult to compute.

**SOMETIMES** we tried to make them look long, sometimes short. The fast vessels we painted to look short and stubby, and we tried to make the slow freighters look as slim and fast as we could. As a result of this sort of camouflage a number of submarines, in the last



#### Which Man Is the Tallest?

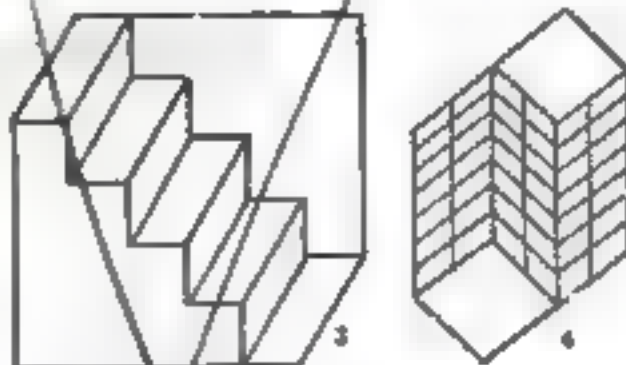
You'll find it hard to believe that these three men are the same size. Yet if you measure them with a ruler you'll find that they are. Your eyes are tricked by the fact that everything in the picture has been drawn in perspective except the three human figures.

few months of the war, so miscalculated the speed and direction of vessels they were attacking, that they came up too close to them, and being unable to train their torpedoes fast enough were promptly run down or captured.

Just to see how effective it was, and how your eyes can be deceived, try out on yourself the surprising tests shown on these pages.

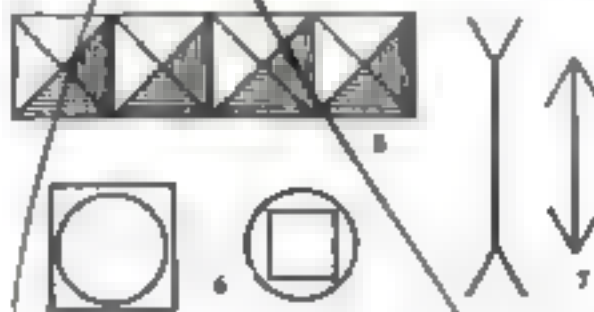
If you have any faith in your eyes, for example, Figs. 3 and 4 probably will remove the last vestige of it. Here are two striking examples of things that seem to change while you watch them.

Do you see the top side of steps in Fig. 3 going up, or the under side of steps going down? Look again. What do you see this time? Maybe you see just a design in black and white. Now, just what do you see in Fig. 4? Is there a solid block with the top toward you on the right, with a kind of wing and an open space or hollow at the left? Or do you see the solid to the left and the hollow space to the right? Or do you see two solids set at an angle to each other? Observe this solid

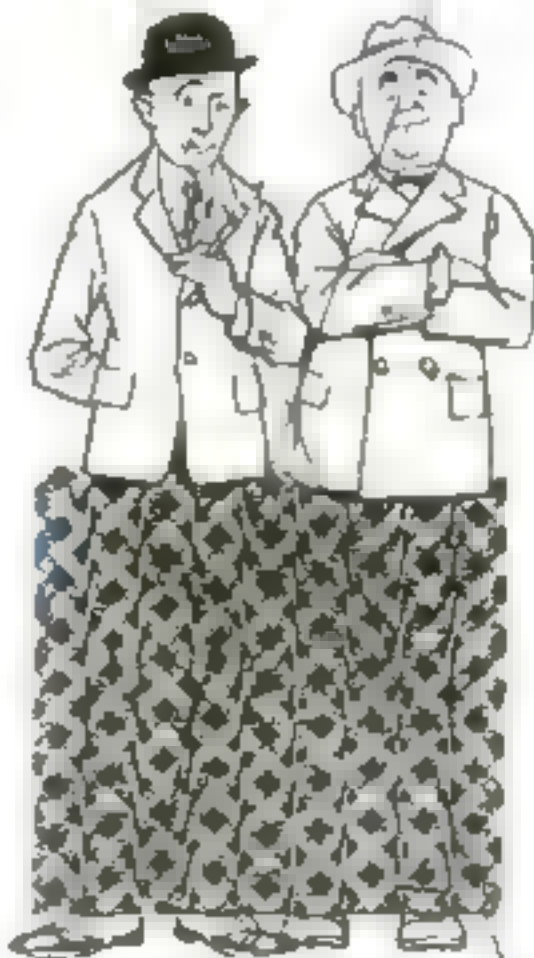


#### They Change before Your Eyes

Look closely at the steps in Fig. 3 for a moment or two. Suddenly you will see them turn upside down before your eyes. You will find that your eyes play the same amazing trick with the dummy-like object in Fig. 4.



Do you see the pyramids in Fig. 5 pointing toward you or away from you? Watch them a moment. You will see them change while you look. Which circle in Fig. 6 looks larger? They're really the same size, right? May as it may seem. And in Fig. 7 does the vertical circular line at the left look longer than the one on the right? It isn't. They're the same length. Your eyes merely have been tricked by slanting lines, in one case pulling the sight beyond the ends of the line as if pulling your sight in toward the center.



#### Legs that Fool You

You'll swear that one of these men is hunched-legged the other knock-kneed won't. Now hold the page on a level with your eyes and look along it from the bottom edge. You will see that all four legs are perfectly straight.

carefully. Does it seem to slip over to the other side while you are watching it? It is an odd sensation to see it change right before your eyes, is it not?

These are examples of what is called "ambiguous perspective," the principles of which we used during the war in paint-

ing ships. These curious coats of various colors were put on, not to render the ship invisible, but to deceive the enemy as to the size and shape and the course it was pursuing.

If you will hold your hand before you silhouetted against a bright area like a very bright sky, you will see, if you move it swiftly to the right, a bright line just behind its back edge, and outside that a dark shadow, a sort of a ghost of the hand itself.

**IT TAKES** a keen eye to see this phenomenon under the most favorable circumstances, but we are told that the light and pursuing shadow are always just behind any swiftly moving object. This is the reason we cannot see a really swift motion. The dark edge following gets confused with the real edge. The camera rarely reveals this, and that is one reason it can show things the eye cannot see. If the fast camera can eliminate this confusion of edges, there seems to be no reason why science may not one day hand us a pair of eyeglasses that will do the same. We have glasses to correct far sight and near sight. Why not glasses for swift sight?

You can be deceived just as easily with color as with shape. If you take a deep red



#### Which Neck Looks Longer?

The man with a long neck usually seeks to make it look shorter by wearing a high collar. Actually the high collar makes it look longer. The necks in the picture are the same length.

background, look at it for a while, then place strips of gray paper against it, the strips will appear a ghostly sort of green. On a blue surface your strips will look orange. Easier than that, try looking at a strong electric light for a few minutes, then look at a blank wall. You'll see the light exactly the same shape, but the color will be purple.

**A BOOK** on dress recently warned against wearing too much orange, because it gave blue shadows to the face. Primary colors—red, blue, yellow, green, orange, and purple—have a tendency to make us see their opposites. In other words, wherever you see one of these, its complement will be hanging around and you will catch glimpses of it now and then out of the tail of your eye.

So, you see, your eyes can't be trusted. Things are not what they seem. At first it may appear rather a low trick for your eye to play you; but when you think about it, I believe you will agree with me that it is a fair arrangement. If the eye could not be tricked into making high spaces seem low, and broad ones slim, you would have to go on living with your imperfections. But with an understanding of the law of tricking the eye by subtle placements of lines and colors, it is pos-

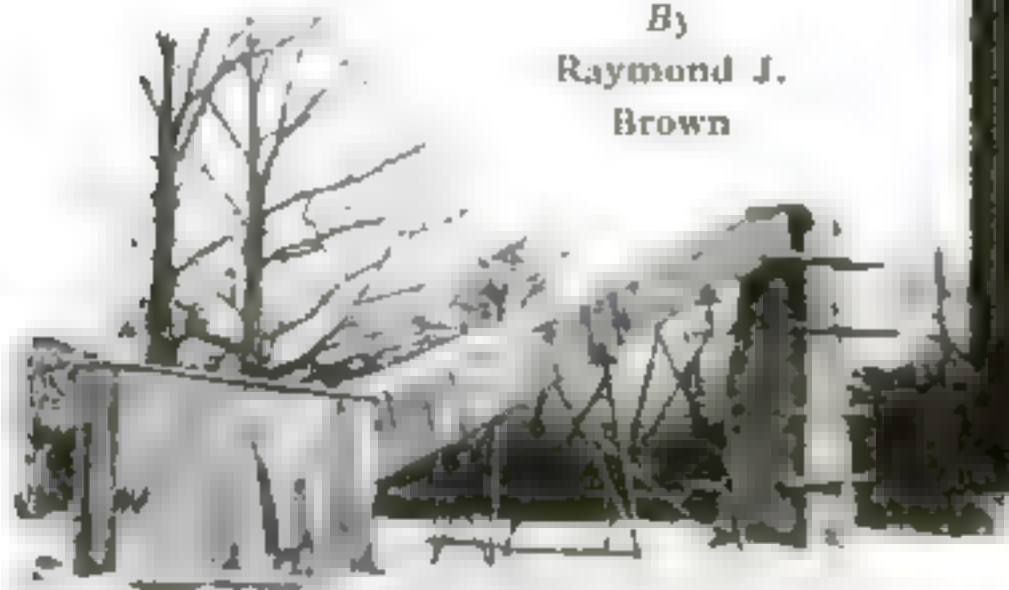
(Continued on page 145)



# Why the Eclipse Was Late

*How Science Is Adding, Little by Little, to Our Knowledge of the Sun*

By  
Raymond J.  
Brown



The Sun in Total Eclipse

A remarkable photograph of the sun in total eclipse, made by the Fairchild Aerial Camera Corporation, is shown here. The sun is seen as a bright ring of light, with the dark disk of the moon in the center. The photograph is a composite of many individual exposures, showing the sun's corona and the surrounding atmosphere.

ON LAST January 24 occurred what was in some respects the most remarkable eclipse of the sun in the history of the world.

More people undoubtedly saw that eclipse than saw any previous one, for the reason that the path of the moon's shadow was across territory more thickly populated than any that the shadow ever had traversed. Likewise, in the path of totality stood a larger number of astronomical observatories than ever before were situated in the path of a single eclipse. Because of available conveniences of transportation, many American astronomers whose permanent stations lay outside the path of totality found it relatively easy to move their instruments and establish temporary stations at places from which the phenomenon would be visible in its entirety. Clear skies virtually throughout the path of totality facilitated observation of the eclipse in all its phases both to scientists and laymen.

Due to recent developments in the science of aerial photography, it was the first eclipse in history of which the world was assured of permanent photographic records no matter what the weather; for, if the day had been dull, airplanes could have ascended high above the clouds and the photographers snapped the hidden sun in the misty light of the upper atmospheric strata.

ALSO, at least one entirely new and unique investigation was made when science seized the opportunity offered by the eclipse to study the mysterious effect of darkness on radio transmission and reception.

In short, Nature arranged and carried out the details of the eclipse like a master stage director, and supplied at one time a gorgeous spectacle for the layman and

the means of making the complex observations through which astronomers have learned all that they know about the sun. The program was a little late in starting, but that was expected, because eclipses, for reasons that will be explained presently, never occur exactly on time; they always arrive a little later or a little earlier than the time predicted.

And so it would seem that with conditions so favorable this eclipse ought to have yielded a wealth of new scientific knowledge regarding the sun. Possibly it will. At the present writing, however, approximately a month after the eclipse, science has but little to report, the reason being that knowledge of the sun is wrung with almost incredible slowness and diffi-

culty from the observations and photographs made at time of eclipse. In fact, the long and complicated calculations and measurements incidental to compiling the mass of data recently obtained scarcely have been begun.

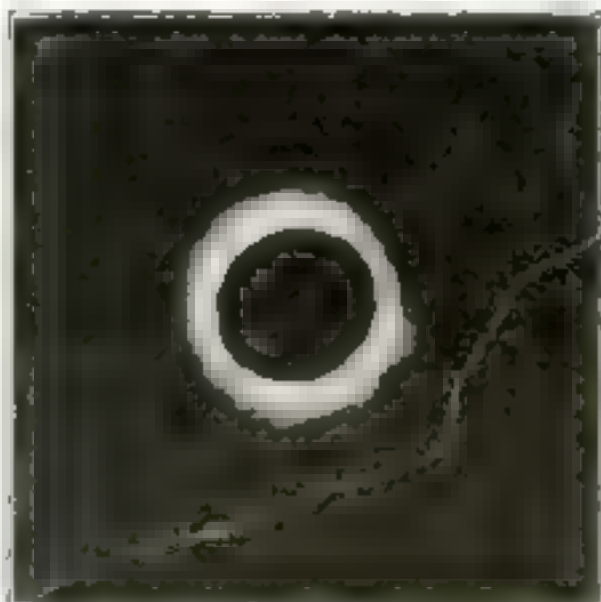
Professor John A. Miller, director of the Sproul Observatory at Swarthmore College, Swarthmore, Pa., leader of an expedition that observed the eclipse from the grounds of the observatory at Yale University, New Haven, Conn., explained to the writer a few days ago why new knowledge of the sun is so rarely obtained.

"WHAT we know of the sun," he said, "is the cumulative results of thousands upon thousands of observations made during hundreds of eclipses and at other times. No one eclipse can be expected to yield results of a startling kind. As an example of the slow way in which things move with regard to the sun, take helium. This element was discovered in the corona of the sun during an eclipse in 1868. Almost 30 years passed before it was learned that helium was a terrestrial element also, and it is only now, a quarter of a century or so later, that men are finding a useful application of helium in the inflation of airships.

There was no discovery made at the recent eclipse comparable in importance with the discovery of helium. Of that we are certain. Just what information of a really important nature the eclipse will yield we will not know for months probably, years, perhaps; at least until we have completed the measurement of our photographic data and our calculations.

"Our photographs already have disclosed one fact of interest to the astronomer—namely, that although it is only 2½ years after the minimum sunspot period, the shape of the corona shows that

(Continued on page 147)



Photographed from the Air

An airplane picture of totality made from a height of 18,000 feet by the Fairchild Aerial Camera Corporation. Note that the sun appears egg-shaped. This distortion is due to the fact that the airplane was moving rapidly when the photograph was made. If, however, the day had been cloudy preventing ground cameras from snapping the spectacle, airplane pictures such as this would have been invaluable for astronomical study.





### Why Colds Spread: Beware of Sneezes and Coughs

If you are in the path of a lousy sneeze such as this you are more likely to catch cold than if you are exposed to severe weather or get your feet wet. For the common cold is extremely

contagious. The corpulent overfed man in the rear, who apparently is the least concerned, is the one who probably is more susceptible to contagion than the thinner passengers

**W**HEN you have a cold—and most of us have one or more each year—do you blame the weather? Most of us do. Miserable and wretched, we speak harshly about the weather, stay indoors, and keep our feet dry.

Now wet feet are not to be recommended at any time, but reports of a recent survey undertaken by the United States Public Health Service indicate that we can no longer be sure of our ground when we blame the weather for a cold in the head or other nose and throat disorders.

This survey is the first effort of its kind to determine when, how often, and why, we suffer from colds, coughs, and allied ailments. The results seem to have upset a number of popular beliefs. Chief among these surprises is an indication that meteorological conditions, at least during the year studied, have little bearing on the prevalence of colds, bronchitis, influenza, sore throat, hay fever, and pneumonia.

This lack of relationship between the weather and the colds in the United States is demonstrated in the startling similarity between cold-occurrence in the frigid North and that in the warmer South and Pacific Coast. In general, New Orleans and San Francisco suffer with Chicago and Boston—and at very nearly the same time of the year.

**T**HIS conclusion, reached by the Public Health Service, is based on reports of health conditions among representative groups of people in Massachusetts, Ohio, Illinois, Maryland, the District of Columbia, Louisiana, Montana, Utah, Arizona, and California, covering a period of a little more than a year.

That colds have their seasonal out-

### What Science Has Found Out about Colds

The common cold is extremely contagious.

It does not come from bad weather or wet feet, but from germs that attack those whose physical condition makes them susceptible.

Each of us, on an average, suffers from 3.7 colds a year.

Colds make no distinction between youth and age. Indoor workers and city dwellers are more susceptible to them than those who have outdoor occupations and live in the country.

Winter is the worst time of the year for colds. Another bad month is January. The month in which you are least likely to catch cold

is June, as is borne out by a study of these reports. The months are, however, that colds are most frequent in the latter part of winter, but that in most sections under survey the highest prevalence of trouble comes in October. For all the winter embraced in the study the October "epidemic" was shown to be perhaps 20 per cent greater than the next highest ratio, reached in January.

During the latter half of October respiratory troubles appear to sweep from coast to coast, and from New England to the Gulf. During November and December the

# COLDS:

By Malcolm MacDonald

ratio declines, until the last days of the year show the average-line within hailing distance of the lowest point between October 1 and June 30. This comes at a season when Massachusetts is in the midst of a New England winter and New Orleans, La., Tucson, Ariz., and San Francisco, Calif., are living outdoors in the sunshine.

**T**HUS do actual health records contradict our common beliefs about colds.

The new year starts with an outbreak of colds that begins late in December, finds its peak in the early days of January, and sharply recedes before the middle of the month. From this time forward to the end of June there is a steady decline in respiratory ailments.

The groups on which the figures of the Health Service are based may be regarded as being fairly representative of the entire population. For the greater portion the survey deals with college students, among whom more than 13,000 individuals were examined. College students are likely to be of the same general age. To offset this selective grouping, and to afford more intimate study of conditions in family life, the research also has embraced groups of families throughout the United States, with reports covering entire households, including



Two Extremes

Indoor workers are more likely to catch cold than those who like the telephone lineman work in the open air. The lineman, however, if subjected to the continued weakening effects of extreme exposure becomes more susceptible to the much greater menace of pneumonia.



## How you get them, how to avoid them, and how to treat them. Vital new discoveries about this most common of man's ailments

servants. These latter groups included the families of medical officers of the army and navy, the medical and scientific personnel of the Public Health Service, and the faculty members of the selected colleges.

**PRELIMINARY** compilations of the investigation, which, by the way, is still in progress, show that in a fairly representative group there were few individuals who escaped colds during a period of 5½ months. The figures also disclose that only 10 per cent escaped colds entirely. In the period studied the individual cold average was 1.9. Should the same rate obtain throughout the year in the country, it means that if you have your share you will have 3.7 colds each year.

In the past there has been no basis for study of the prevalence of such minor ailments as the common cold. Such ailments are not included in the lists of diseases that must be reported to the local authorities. But by continued investigation the Public Health Service hopes to obtain much additional information as to the prevalence of respiratory ailments and their causes.

While the data so far gathered shows clearly that all sections suffer from numbers of common colds at about the same time of year, the outbreaks in New Orleans are entirely independent of those in Chicago, Boston, and San Francisco. Apparently there is no exchange of infection in these outbreaks. The attacks come relatively simultaneously.

Another phase of identity is found in the duration of illness. From north to south and from east to west the average length of disability for all respiratory disorders is slightly less than 6½ days.

Medical experts on the subject tell me that the common cold is no respecter of years, but comes to old and young alike. The same may be said concerning sex. Apparently boys and girls, men and women are equally susceptible.

When it comes to a comparison between town and

country, there seems to be an advantage in favor of the person living away from the congested centers. The reasons are obvious. City houses are apt to be overheated. The evidence brought forward by medical observers tends to prove that where an indoor temperature of more than 70 degrees is maintained during cold weather, there is an increase in respiratory disorders.

The reason for this is that in overheated rooms the relative humidity of the air, on which our health and comfort largely de-

pend, is likely to be unusually low. "Relative humidity" means the amount of moisture in the air in comparison to the amount that the air could possibly hold. If the relative humidity of the room is 50 per cent we understand by that that the air in the room has just half as much moisture in it as it could possibly hold at that particular temperature. Its ability to hold moisture increases as the temperature is increased.

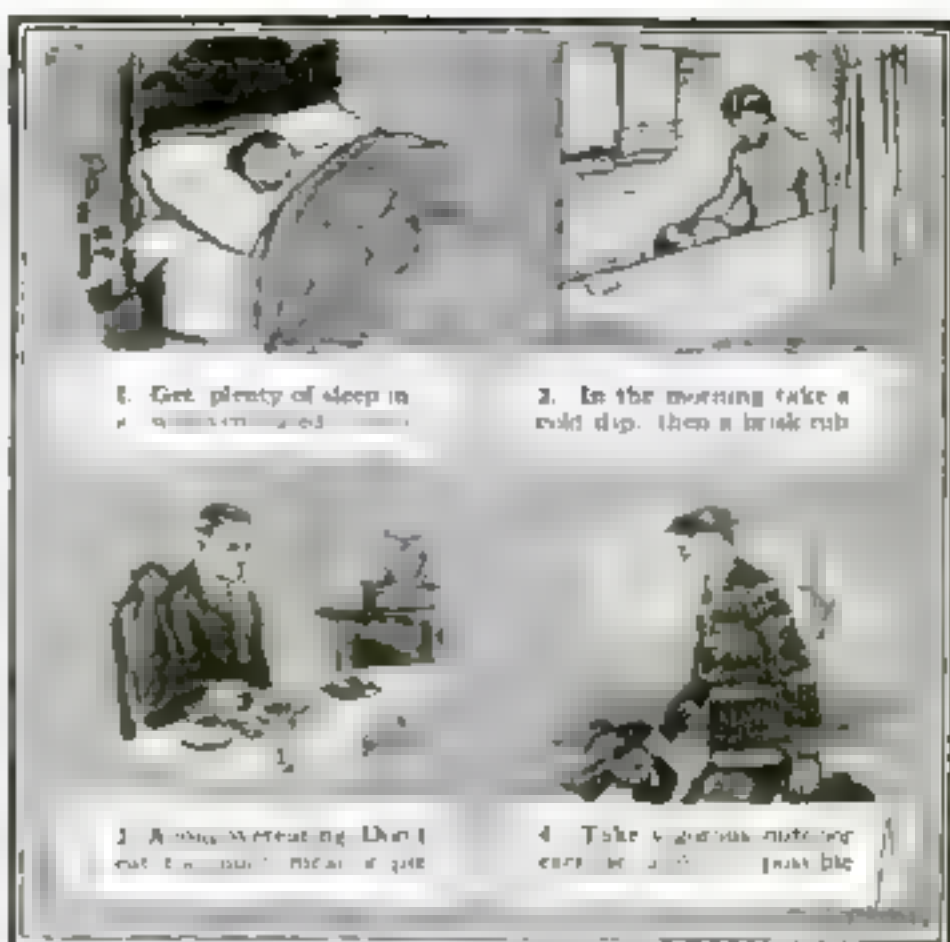
**IN THE** wintertime the temperature of the outside air is very low, and consequently the amount of moisture in it is very low. When this dry air from the outside comes into the house, it is warmed. This makes it capable of holding much more moisture than is already in it. Consequently the relative humidity of the air in the home is very low.

In many homes the air in the wintertime is drier than the air over a desert.

The results are that the perspiration from our bodies evaporates very rapidly, making us cold, although the room is quite warm as far as the temperature is concerned. If the relative humidity of the home is between 50 and 60 per cent, a temperature of 68 degrees will be found very comfortable; while with dry air a temperature of from 70 to 75 is necessary for comfort.

This hot dry air is very irritating to the nerves and injurious to the eyes. It makes

(Continued on page 44)



Four Ways to Avoid Catching Cold



### Make Your Own Hygrometer

An efficient hygrometer or wet and dry thermometer with which you can determine the relative humidity of your rooms can be made easily from two ordinary household thermometers as shown in the illustration. Simply mount the thermometers on the same board and keep the bulb of one of them moist by means of a cloth tied around the bulb and dipped into a small medicine vial filled with water. The table below will enable you to determine the humidity from the difference in the readings of the two thermometers. For healthful conditions the humidity should be above 50 per cent.

### How to Find Relative Humidity

**SUPPOSE** the dry bulb reads 70 degrees and the wet bulb 60. The difference will be 10 degrees. Now run down the column that has the

Figure 10 at the top until you come to the horizontal column corresponding to a dry-bulb reading of 70. At this point the number is 56, the relative humidity.

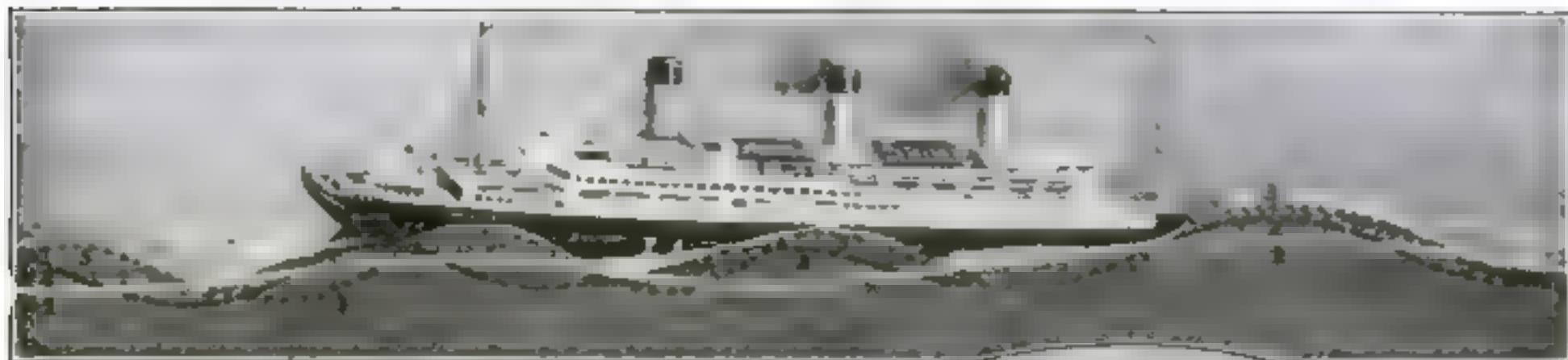
Difference between dry and wet bulb thermometers

| Dry | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 50  | 93 | 87 | 81 | 74 | 68 | 62 | 56 | 50 | 44 | 39 | 33 | 28 | 22 | 17 | 12 |
| 52  | 94 | 88 | 81 | 75 | 69 | 63 | 58 | 52 | 46 | 41 | 36 | 30 | 25 | 20 | 15 |
| 54  | 94 | 88 | 82 | 76 | 70 | 65 | 59 | 54 | 48 | 43 | 38 | 33 | 28 | 23 | 18 |
| 56  | 94 | 88 | 82 | 77 | 71 | 66 | 61 | 55 | 50 | 45 | 40 | 35 | 31 | 26 | 21 |
| 58  | 94 | 89 | 83 | 77 | 72 | 67 | 62 | 57 | 52 | 47 | 42 | 38 | 33 | 28 | 24 |
| 60  | 94 | 89 | 84 | 78 | 73 | 68 | 63 | 58 | 53 | 49 | 44 | 40 | 35 | 31 | 27 |
| 62  | 94 | 89 | 84 | 79 | 74 | 69 | 64 | 60 | 55 | 50 | 46 | 41 | 37 | 33 | 29 |
| 64  | 95 | 90 | 85 | 79 | 75 | 70 | 66 | 61 | 56 | 52 | 48 | 43 | 39 | 35 | 31 |
| 66  | 95 | 90 | 85 | 80 | 76 | 71 | 66 | 62 | 58 | 53 | 49 | 45 | 41 | 37 | 33 |
| 68  | 95 | 90 | 85 | 81 | 76 | 72 | 67 | 63 | 59 | 55 | 51 | 47 | 43 | 39 | 35 |
| 70  | 95 | 90 | 86 | 81 | 77 | 72 | 68 | 64 | 60 | 56 | 52 | 48 | 44 | 40 | 37 |
| 72  | 95 | 91 | 86 | 82 | 78 | 73 | 69 | 65 | 61 | 57 | 53 | 49 | 46 | 42 | 39 |
| 74  | 95 | 91 | 86 | 82 | 78 | 74 | 70 | 66 | 62 | 58 | 54 | 51 | 47 | 44 | 40 |
| 76  | 96 | 91 | 87 | 83 | 78 | 74 | 70 | 67 | 63 | 59 | 55 | 52 | 48 | 45 | 42 |
| 78  | 96 | 91 | 87 | 83 | 79 | 75 | 71 | 67 | 64 | 60 | 57 | 53 | 50 | 46 | 43 |
| 80  | 96 | 92 | 87 | 83 | 79 | 76 | 72 | 68 | 64 | 61 | 57 | 54 | 51 | 47 | 44 |



# What Huge Seas Do to Ocean Liners

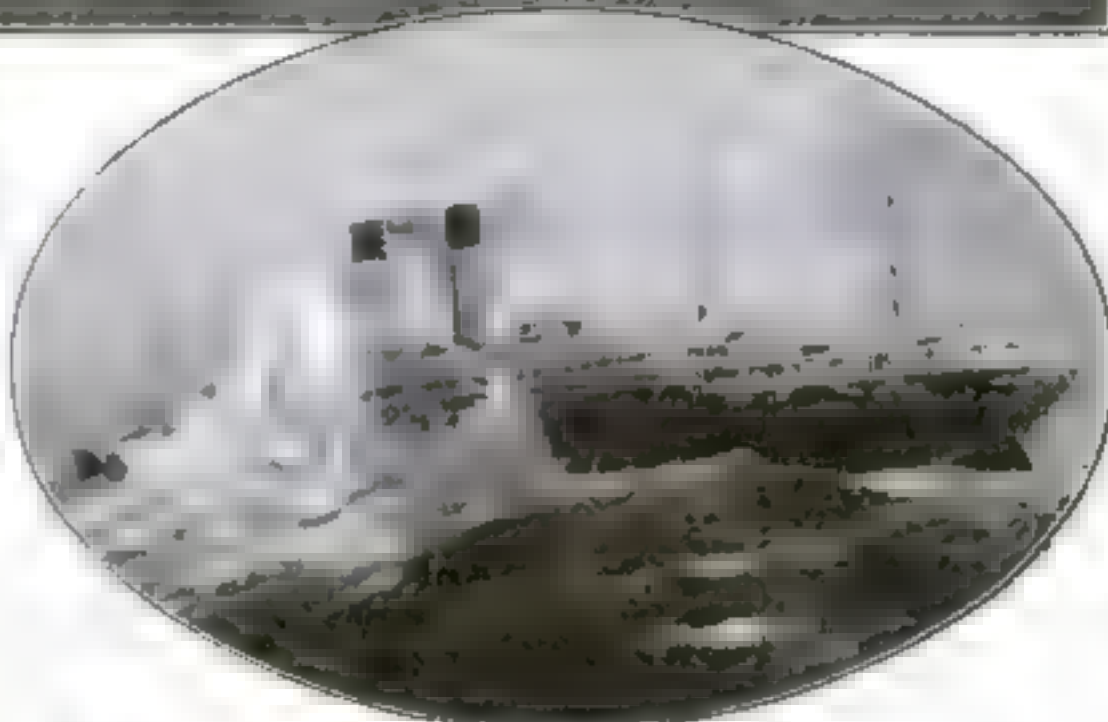
## An Explanation of the Origin of Recent Giant Waves



What Causes a Mountainous Wave? 1, 2 and 3 represent three separate series of waves of different lengths. Occasionally the crests and troughs of the series coincide, piling up a huge wave, as shown at the right. If a liner is caught in such a wave, she takes the full force of the wave striking her bow.



**A Dangerous Beam Sea**—This picture shows what happens when a great liner, with none of her hulls up and down, is caught in a beam sea. The huge waves, piled by reason of their waves meeting.



**How Most of the Damage Is Done**—When a large liner rolls with maximum velocity into the trough of one of the great waves,

the full force of beam seas crashes against her sides. Because of her weight and size, the ship has little "give" before such a battering.



**Why the Big Ship Gets the Worst of It**—A heavy wave strikes a big liner with greater force than it does a smaller ship because the latter offers greater resistance. The smaller ship, at left, can "give" more to the sea, as indicated by the dotted lines.



**The Pitch of Ships**—A long, heavy liner, pitching regularly, does not rise quickly to a heavy wave, with the result that a deluge

of water occasionally pours over the bows. But a trawler, smallest of sea-going ships, quickly rises and falls over the crest of the wave.

**When gales struck Atlantic**—The worst of the great storms were the ones that struck the Atlantic coast. The ships were in great danger, and passengers were in great peril. Even on the *Lusitania*, the world's largest ship, passengers were in great danger.

The average height of waves during an Atlantic gale, mariners say, is about 4 feet. How, then, do waves rise to such a height as to damage the decks and fittings of liners often from 80 to 90 feet above the normal water line? By the aid of picture and line the artist, G. H. Davis, has given a graphic explanation.



# The Inventors Who Speed YOUR MAIL

*Marvelous Time-Saving Machines  
Devised by U. S. Postal Employees*

By Norman C. McCloud



**Twin Letter-Boxes**

One of the boxes is for local letters, the other for domestic and foreign mail—a simple new idea that saves time in sorting at the post office.

I WAS in the office of a New York business man on a Monday afternoon a few weeks ago while he was signing his day's correspondence.

"Here's a letter that must get to San Francisco by Saturday," he said. "I wonder if I ought to send this by mail." No, he decided, "It will get there Friday night and be delivered on Saturday by ordinary mail."

And without another thought of the matter, he went on signing the remaining letters.

Most of us are like that man. We take the mails for granted. When we address a letter to a place two days' railway journey away, we mail it in entire confidence that it will be in the hands of the addressee at the end of the second day.

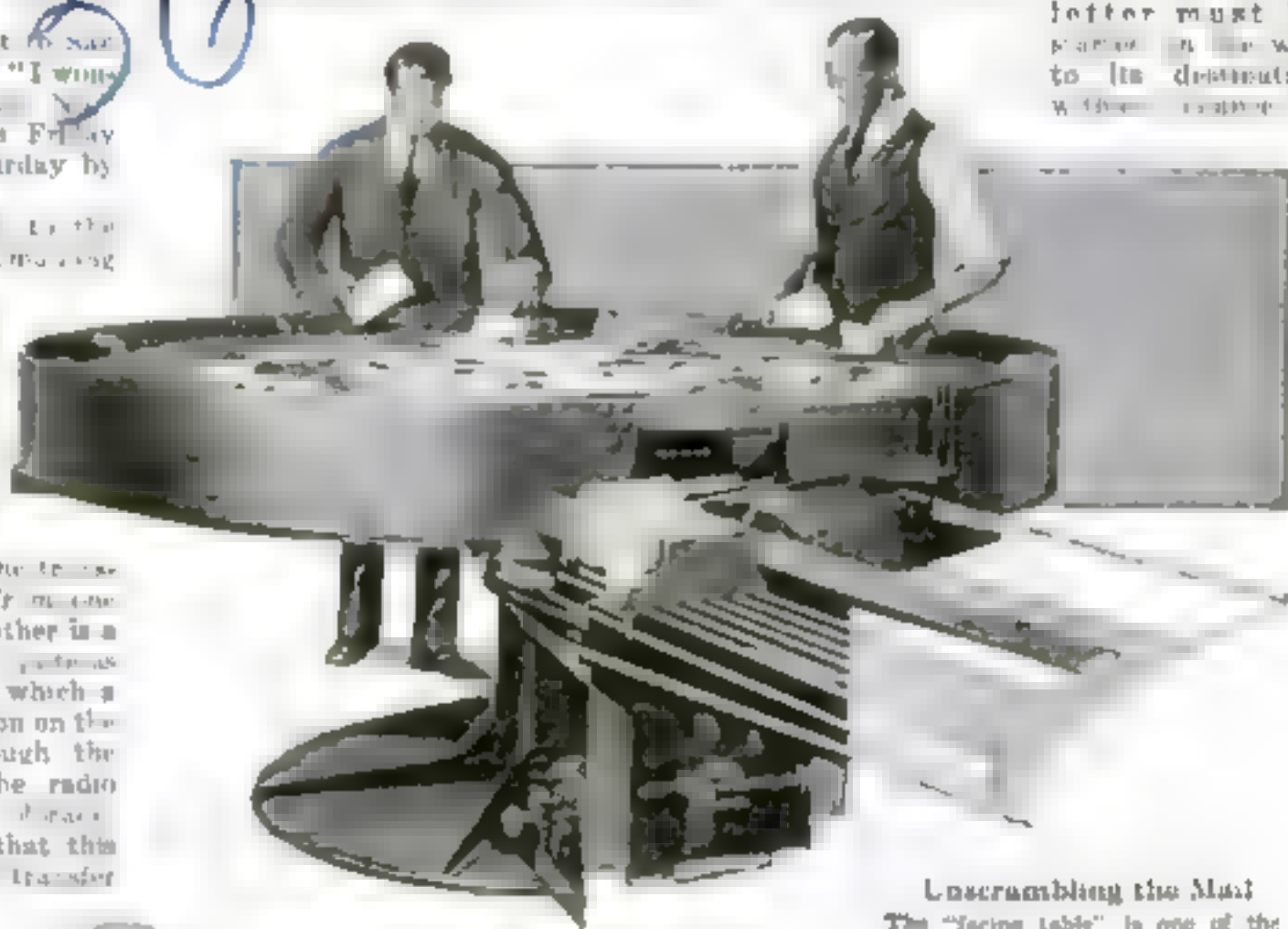
Few, I am sure, realize that the transfer of a piece of mail matter from one part of the United States to another is a process quite as complicated and as wonderful as is the process by which a song sung in a broadcasting station on the Atlantic Coast is hurled through the ether to be reproduced by the radio receiver owned by a man in Chicago. Few, too, I am sure, suspect that this seemingly simple process of mail transfer is accomplished largely through the agency of a vast number of ingenious mechanical devices that have been developed for that sole purpose. And it is only by the invention of these time-saving and labor-saving devices that the Post Office Department has been able to keep abreast of the tremendous pressure of modern business and industry. It permits no operation to be performed by human hands that can be performed more accurately, efficiently, and speedily by machinery.

THE department maintains an Engineering Division that is charged with the responsibility of speeding the mails by means

of improved practices and newly invented equipment. Congress encourages inventive genius within the postal service with a fund to provide cash rewards for employees who develop devices adopted by the department. As a result, some of the most valuable inventions that speed your letter to its destination have been developed by postal shop workers.

Take the facing table, for an example.

Every hour collectors in the crowded business sections of our large cities dump into post offices thousands upon thousands of letters. These are addressed to every corner of the earth, they are in many sizes; in bundles and separate. The envelopes face in every possible direction. Some are upside down. Others are crosswise and askew. And this chaotic mass must be put in order. Each letter must be placed in the way to its destination with the proper of



**Unscrambling the Mail**

The "facing table" is one of the most important of the new time-saving devices. Letters by the thousands are dumped in a jumble on the surface, which looks like a long, low table. The clerk then, with a long-handled fork, picks up each letter, turning it so that the address is facing up. The letters are then placed in a slot at the edge of the table, where they are carried to their proper pigeonholes.



**A Mechanical Sorter**

As letters are fed mechanically into this remarkable machine, the operator simply notes the address of each and presses a corresponding key on a keyboard. The machine then automatically carries the letters to their proper pigeonholes.

But the facing table has saved the department thousands of dollars in the purchase of clerks, and has saved the government many thousands of dollars in the purchase of clerks.

But the facing table has saved the department thousands of dollars in the purchase of clerks, and has saved the government many thousands of dollars in the purchase of clerks.



On this surface are dumped the letters. The clerks shuffle them about, turning them right side up, and drop them into the slot. The letters fall to the revolving platform, and are carried along to outlets at the far side of the table—long envelopes going into one channel, ordinary correspondence-size envelopes into another. They emerge neatly packed in stacks according to size, each letter face up and with the stamp in the upper right-hand corner, ready for the canceling machine.

This facing table supplies an outstanding example of the spirit of coöperation

directed to every state in the Union and every country in the civilized world.

The established method of distributing outgoing mail has been by hand. Thus a clerk in the New York post office, for example, stands before a case containing about 60 pigeonholes, each marked with the name of some important city or geographical area, and tosses each letter into its proper niche.

For years the postal authorities sought a better and more efficient way. Many machines invented for the purpose failed to solve the problem, until recently an Ohio manufacturing concern produced a device that literally can perform every operation of distributing mail except reading the addresses.

I saw this machine only one in use at a post office recently at the Washington post office. Letters are fed into the machine mechanically and pass before an operator who selects a key resembling that of a typewriter, except that the keys represent geographical areas instead of

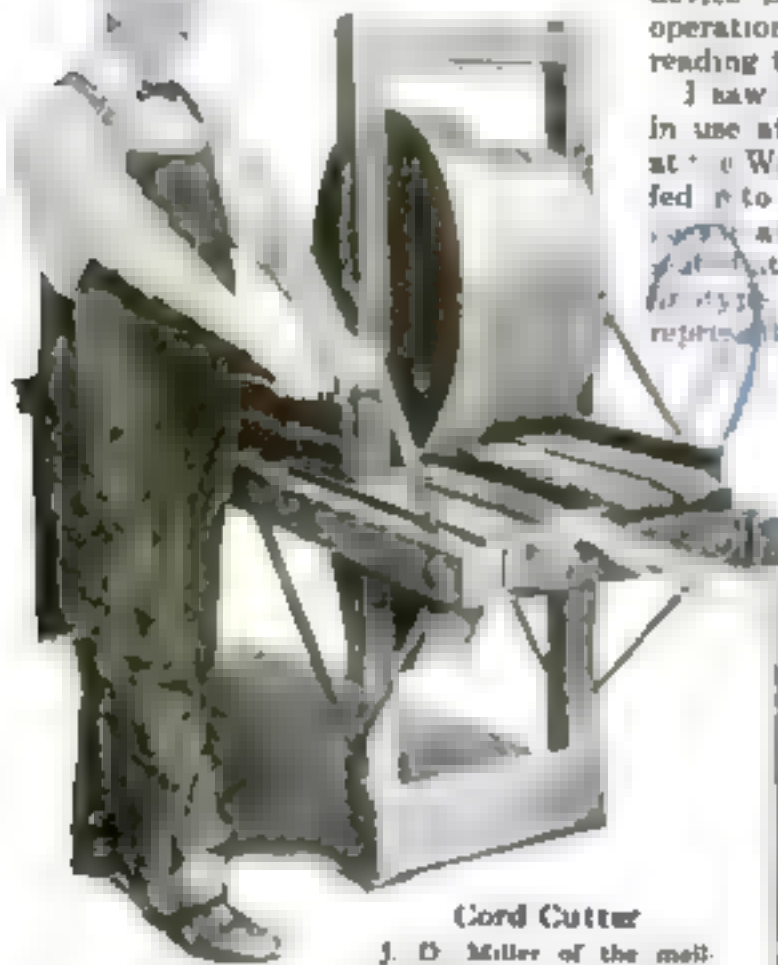
place. When the letter reaches the pigeonhole for which it is intended, it is discharged into it. The pressing of the key sets a trigger on the container that is released only by the mechanism connected with the proper pigeonhole. There are 120 of the latter, twice as many as usually are contained in the cases used for hand distribution. This permits finer distinction in sorting and makes unnecessary a second sorting.

THESE inventions, of course, touch only one phase of the important operation of keeping the mails moving—handling incoming mail matter. Transporting the sorted mail to its destination is the next step. Here, too, the Post Office Department has made generous use of the gifts of science and the products of inventive minds, both in speeding the mail and safeguarding it in transit.

And speaking of safeguards, the Engineering Division has called on science to aid it in supplying protection against bandits. Recently there was put into service a bandit-proof railway mail car, a veritable fortress on wheels, equipped with ingenious devices to protect it against attack. Its walls, roof, and floor are armored like the sides of a battleship, entirely bullet-proof. It is equipped

with portholes through which shotguns may be poked to repel an assault. Around the barrel of each gun is a metal ball, which, when the weapon is thrust through the porthole, closes the latter tight, and permits the gun to be swung through a wide angle.

In the portholes also may be placed magnesium candles, which will light the country for half a mile around and expose robbers to the bullets of marksmen within the car. Should a robber seek to escape the bright glare by diving beneath the car, he is subject to a rain of bullets from shotguns that project through the floor.



**Cord Cutter**

J. D. Miller of the mail-equipment shops operating the machine he invented for cutting 20 lengths of cord in one movement of a lever.

and loyalty that pervades the technical arm of the postal service. The necessity for such a device had been recognized. Employees of the Mail Equipment Shops attacked the problem and speedily produced the table.

Without this table the canceling machine, which in large post offices has superseded the old-time practice of canceling stamps by hand, would be entirely useless. A foreman in the Washington post office demonstrated this to me recently when he placed an armful of unsorted and unsorted dummy letters in the canceling machine. The envelopes emerged with the cancellation marks virtually every place on the letters except where they belonged.

THIS machine handles the normal run of letters—envelopes of various sizes and shapes—at a rate of 10 a second. Gas and telephone bills, or other commitments of mail matter of uniform size and shape, can be canceled in this machine at the amazing speed of a thousand a minute.

However, these two machines do not solve the entire problem of getting the mail out on time. There still remains the highly difficult task of sorting the letters according to the destinations to which they are addressed. Virtually every collection in a big city brings in letters

#### A Lock that Won't Slip

The problem of making a mailing-cord lock that wouldn't slip was solved by Thornton L. Richardson with the lever attachment shown below. This clamps the cord securely from above.



**Cutter-Stamp**

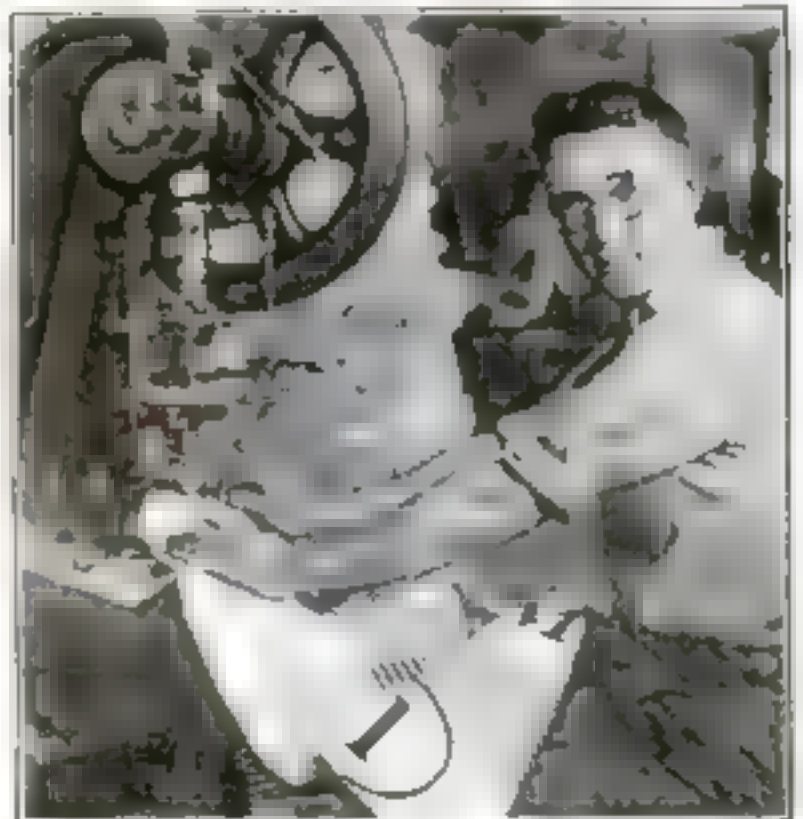
A combination cord cutter and stamp. The blade is on the side.



**Twine Holder**

An automatic twine holder, which is used for holding twine in the mail boxes.

the letters of a particular address. As the operator reads the address of a letter, he presses the key that corresponds. The letter moves along in a container, and is picked up by one of a number of metal carriers on an endless chain. This conveyor carries the container over a series of pigeonholes, each a receptacle for mail for a particular



**Simple Spring Device Saves Fingers**

Before A. E. Wilde, a postal worker, invented this safety attachment for punch presses used in manufacturing mail bags, 31 employees had lost fingers in the presses. His device—a spiral spring—has practically eliminated such accidents.





### A Terror to Bandits

Such a big bulletproof mailbag is used by the U. S. mail. This closes the porthole tightly when the gun barrel is thrust through.

Beneath the car are metal cones that scatter bullets in all directions. Numbers of cars of this type probably will be constructed in the near future.

Major inventions issue from the Mail Equipment Shops almost daily. One of the most striking of these devices recently developed is a non-crushable mailbag. The bag, big and strong, does not owe its durability to transverse bracing as might be suspected. The secret lies in reinforcing it with a quarter-inch of "plymetal," a newly developed material that absorbs all weight and shock, distributing them through the length and breadth of the bag.

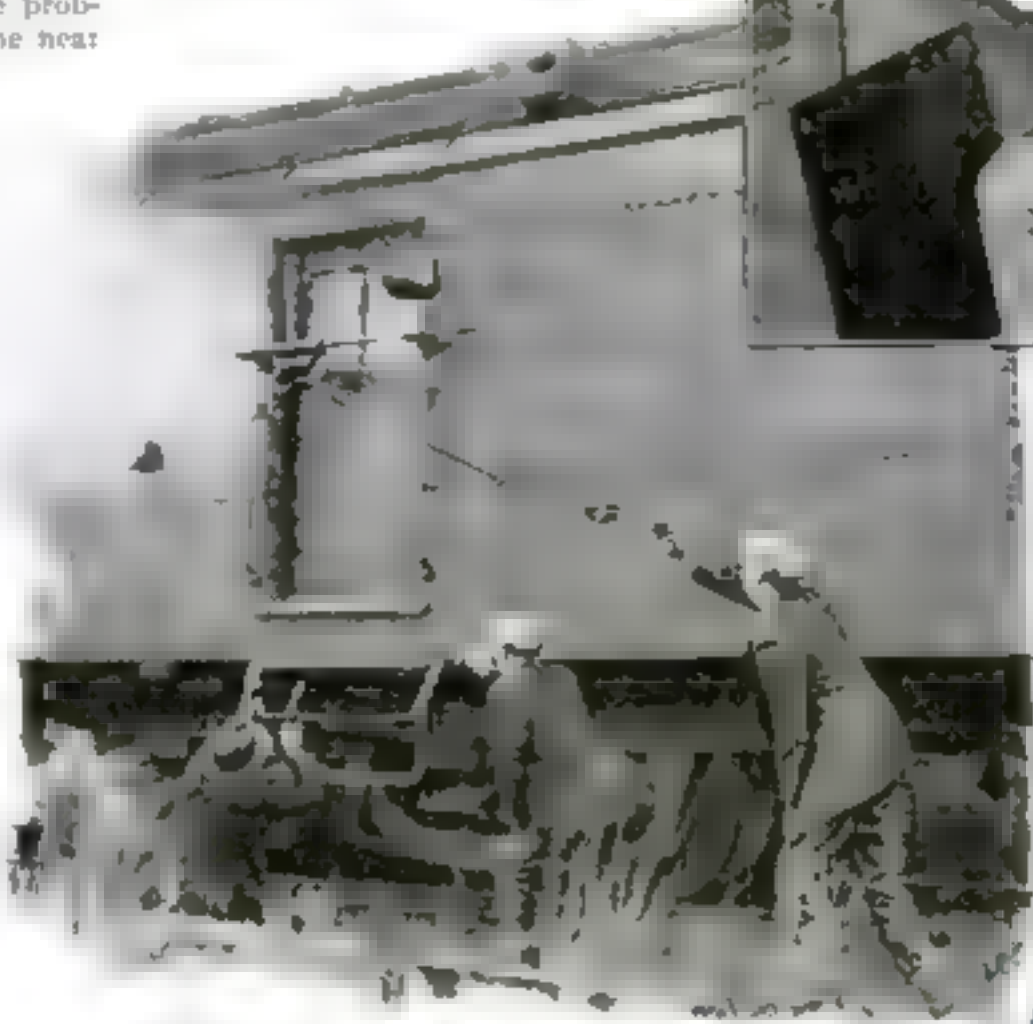
**TO PROVE** to the public that the bag will really stand up to the rigors of service in transit, W. Farnsworth, Chief of the Engineering Division, packed several empty pasteboard shoe boxes in one, and then had a 200-pound postal employee stand on it. The boxes came out just as they had gone in. Because the bags are flat and compact, many of them may be packed on one car, thus permitting packages that ordinarily would have to wait for the next train to go forward.

The problem of devising an effective fastening device for mailbags was one of the most troublesome that the technical men of the Post Office Department ever faced. For years, bags had been fastened by a cord lock that slipped at annoying moments. Dozens of substitutes had been tried, only to be discarded.

A few months ago, however, Thornton L. Richardson of the Mail Equipment Shops in Washington received a cash award for devising a method for bending tumbler springs for mailbag locks. The government's recognition of this invention inspired Richardson

### He Can't Crush It

To test the protective quality of a newly developed non-crushable mailbag, a 200-pound postal employee stood on the top of one of the bags containing just two empty shoe boxes. The boxes remained undented by the weight



to tackle the fastener problem. As the result, he invented a lever attachment that clamps the cord lock from above, engaging the cord lengthwise and holding it secure under any conditions of use. His device is now standard equipment, and he has received his second cash award, a few months, this time for doing a thing that "couldn't be done."

J. D. Miller, of the Mail Equipment Shops, recently evolved a simple machine that in one motion cuts 20 lengths of the cord required for fastening mailbags. Another ingenious employee saved the Post Office Department a large sum of money by perfecting a holder that keeps in place and prevents loss of the twine used by carriers and clerks in tying bundles of mail. And a recently devised combination canceling stamp and cord cutter, to be used by post office clerks in opening bundles, is a third clerk's contribution to the movement of the mails.

Sometimes there is an element of humor in these inventions by postal workers as, for example, when Tony Lombardi devised a "jig" whereby he doubled the amount of work he



### Repelling an Attack

In the case of robbers, a gang of postal clerks recently staged a real-life test of the efficiency of the new bulletproof mailbags. The photograph on the left shows them standing by the car while a man got back a car. While in the car, a bullet struck the car, but the bullet was stopped by the bag. The photograph on the right shows the mailbags and the car. The bulletproof mailbags are shown in the foreground, and the car is in the background. The bulletproof mailbags are shown in the foreground, and the car is in the background.

could do in operating a machine for removing keyholes in mailbag locks. Tony kept his invention to himself, fearing he might be discharged for daring to make an unwarranted improvement on a government machine. It was not until his superiors noticed how much more work he was turning out than any other man in the shop that his device came to light. Then, to Tony's utter astonishment, he received a cash award, a citation from the Postmaster-General, and his "jig" was made standard equipment.

**ONLY** a short time ago, another cash award was made to A. E. Wilde of the Mail Equipment Shops, for a safety attachment for the punch presses used in the manufacture of mailbags. Before this attachment—a spiral spring that warns the operator of the drop of the punch—was installed, 31 employees had lost their fingers in the presses. Since the adoption of the device there have been few accidents in that department.

Airplanes, motor-trucks, and even caterpillar tractors, are carrying the mails today to people in remote sections. For every letter and every package that is deposited in a mailbox must go forward to its destination without delay. That is the creed of the Post Office Department, and storms, ice, snow, and countless other agencies seem to conspire to prevent its being carried out. Against these opposing forces the postal authorities have marshaled the powers of modern science.



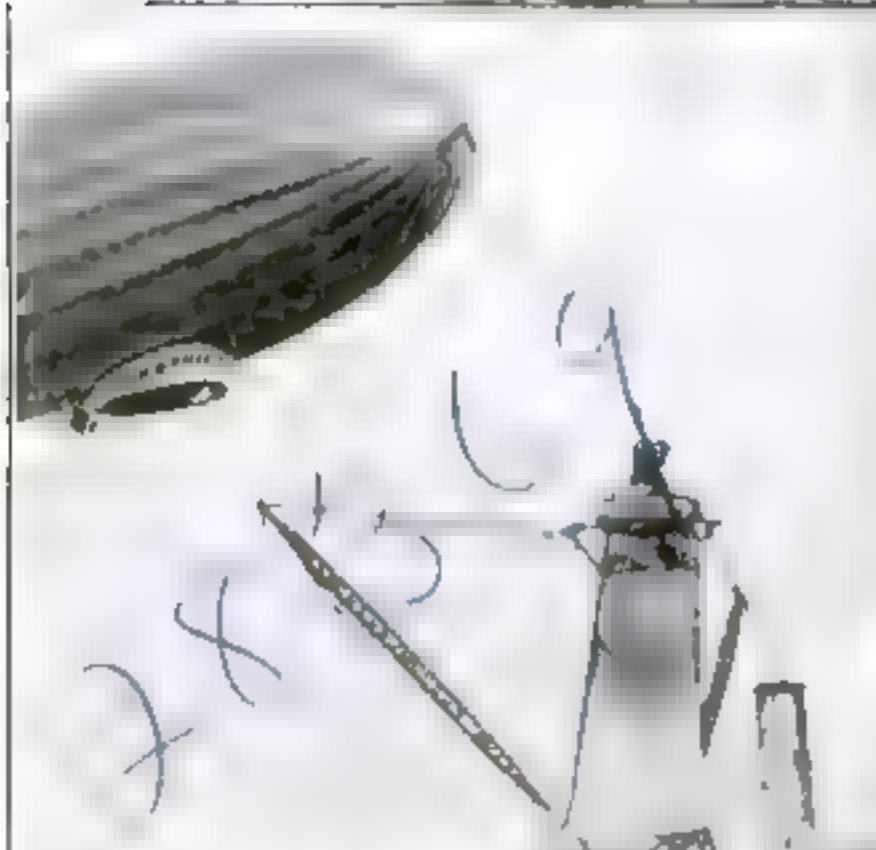
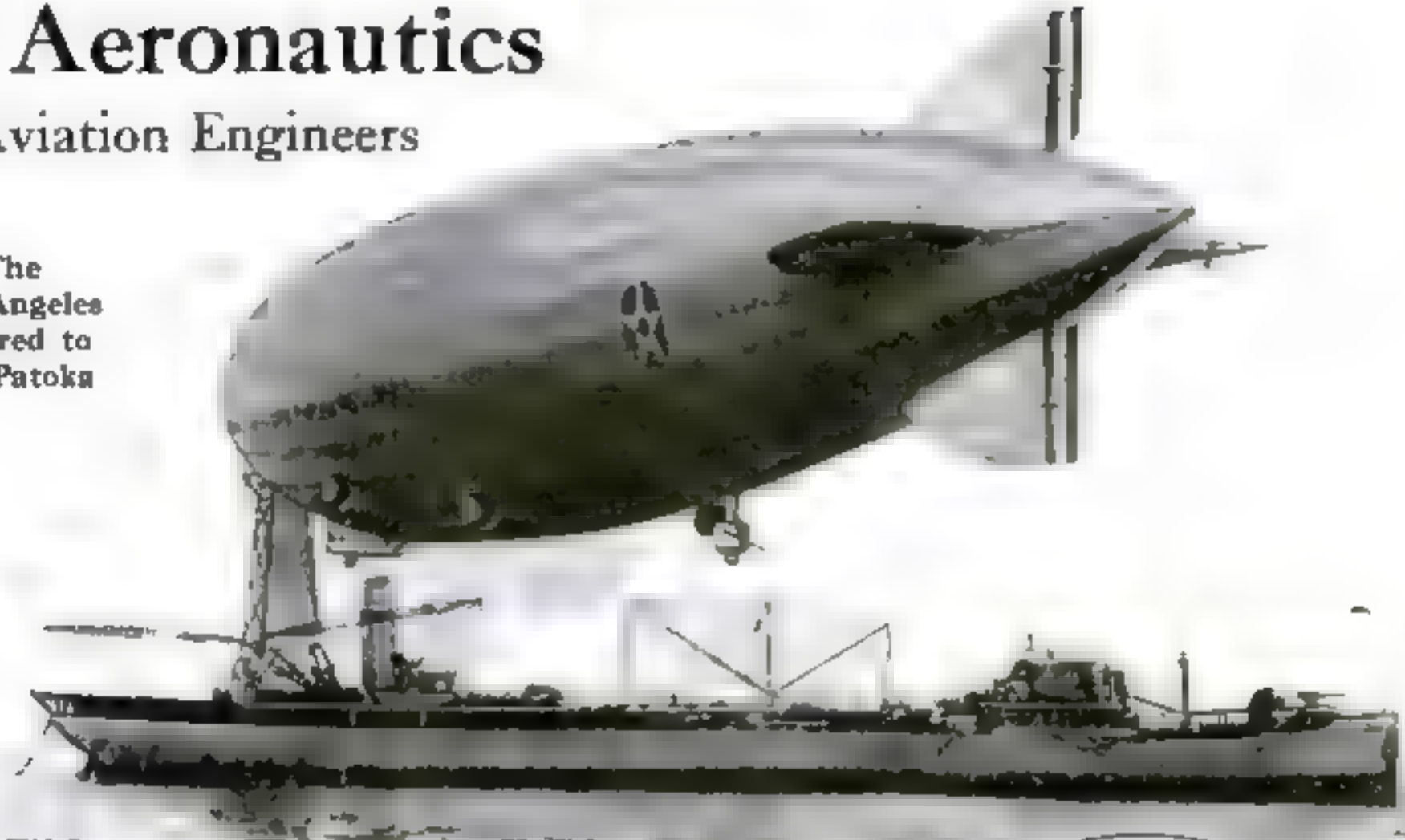




# in Aeronautics

## by Aviation Engineers

The  
Los Angeles  
Moored to  
the Patoka



Above is seen the great dirigible *Los Angeles* under tow for the first time by U. S. S. *Patoka*, the only ship in the navy equipped with a mooring-mast. This test took place recently in Chesapeake Bay and, like previous tests between the *Patoka* and the *Shenandoah*, was entirely successful.



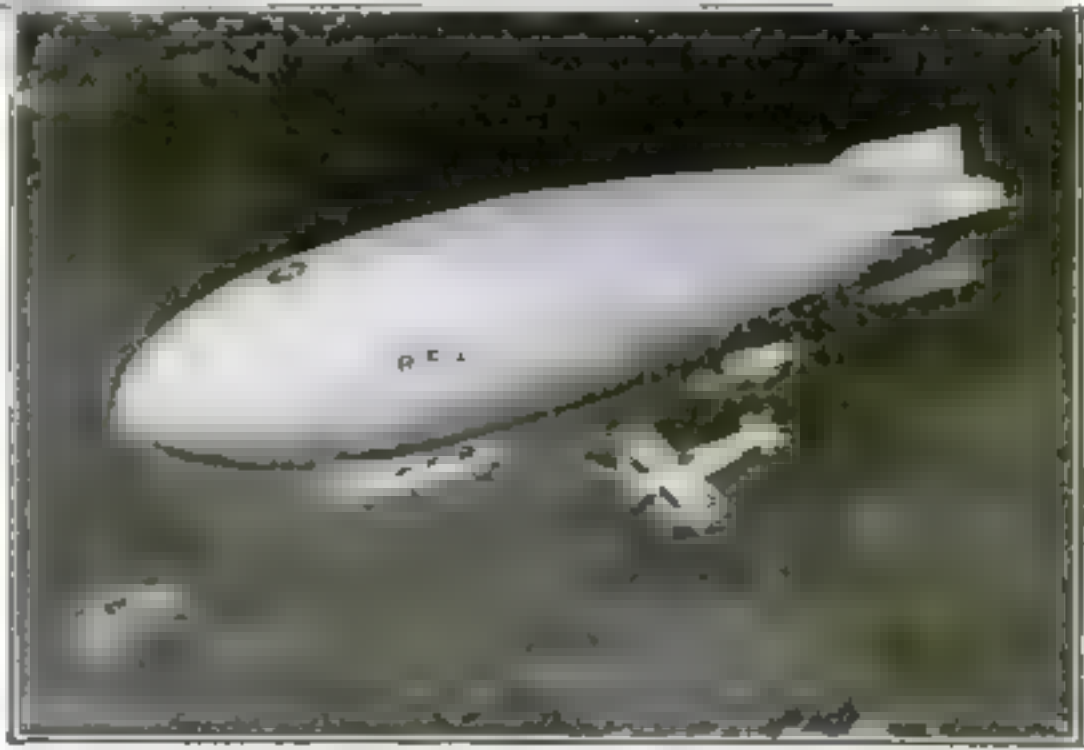
The *Los Angeles* remained moored for 45 minutes while the *Patoka* steamed up the bay. Then storm warnings caused the dirigible to return to her hangar at Lakehurst, N. J.

Effecting a contact between a dirigible and a mooring ship is a difficult and complicated operation. Here the *Los Angeles* is shown being hauled by cable toward the ship's mooring-mast.



### Plane-Catcher

How England purposes to enable the dirigible R-101 to pick up air planes in flight. Guided by a mirror, the pilot maneuvers his plane until a spring catch on the wing engages a special cable device lowered from the airship.



Artist's conception of the R-31, the first semi-rigid dirigible ever constructed in this country, now being assembled at Belleville, Ill. This ship will be able to launch scout planes and pick them up again.

28370

28185



# Weather Man Makes His Own Climate



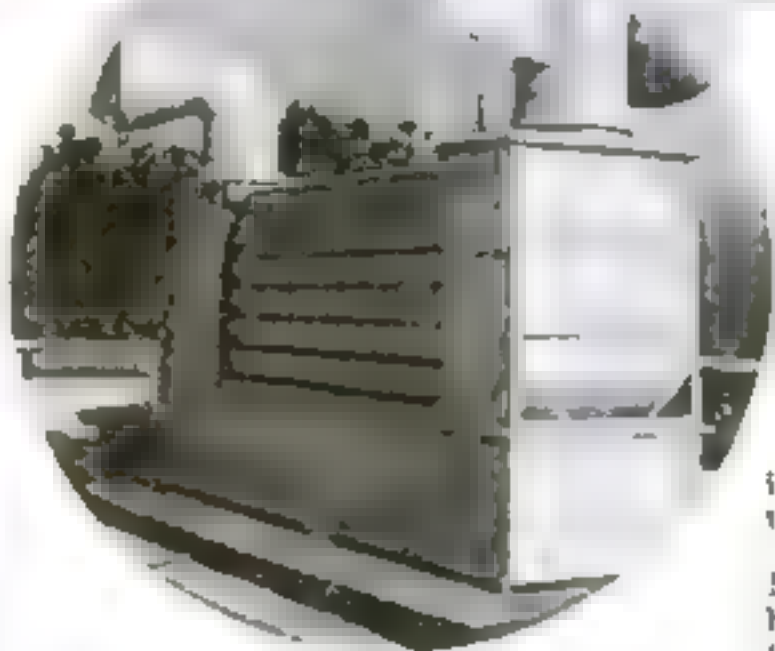
Professor Moore's home with air-purifying device on roof is shown above. A closer view (at right) shows the two funnels one turned toward the wind. Air is forced through water in the large metal box



The inventor comparing the percentage of humidity of the air out of doors with that inside the house



Air enters through unobtrusive ceiling registers. The amount of air admitted can be regulated by pulling the cords that can be seen above hanging from the register



**A**S CHIEF of the United States Weather Bureau in Washington from 1895 to 1918, Prof. Willis Luther Moore studied weather and climate closely. He was especially interested in humidity. When he built a home in Pasadena, Calif., recently, he installed in it a unique system of ventilation.

On his roof he built a water-cooling device for humidifying and purifying the air. A large intake funnel is faced to the wind by

means of a weather-vane. Air from this funnel is forced through water and thence carried to all rooms of the house through ventilation pipes. A smaller funnel, which carries off the used air, is faced away from the wind.

Each room has two ventilators in its ceiling. One admits the fresh air and the other takes off the impure air.

In one test of the system Professor Moore found that with an outside humidity of 41 per cent the inside registration was 74 per cent. The percentage can be regulated to suit the convenience of the dwellers, he says. The system is applicable to any climate. With proper furnace control and a means of regulating humidity, such as this system affords, ideal home climate is possible in any weather.

Physicians agree that high relative humidity in the atmosphere of a home is of vital importance in preserving health.

## Actors Radio Play to Deaf

**O**NE hundred deaf persons, who could not have heard a word without mechanical help, were guests recently at an unusual theater party in New York City. Installed in various parts of the theater was an adaptation of the public address



A scene in the play heard by a deaf audience. The microphone is concealed. At right: Persons in the audience equipped with head phones



system that can be used when addressing large crowds.

The system consisted of a microphone that picked up every sound, a vacuum tube amplifier, and 10 sets of head phones for those more seriously deaf. The listeners, to whom a play had been running more than a month previously, reported that they heard every word. They are hopeful that the experiment will open the doors of the theater to thousands to whom, until now, they have been closed.



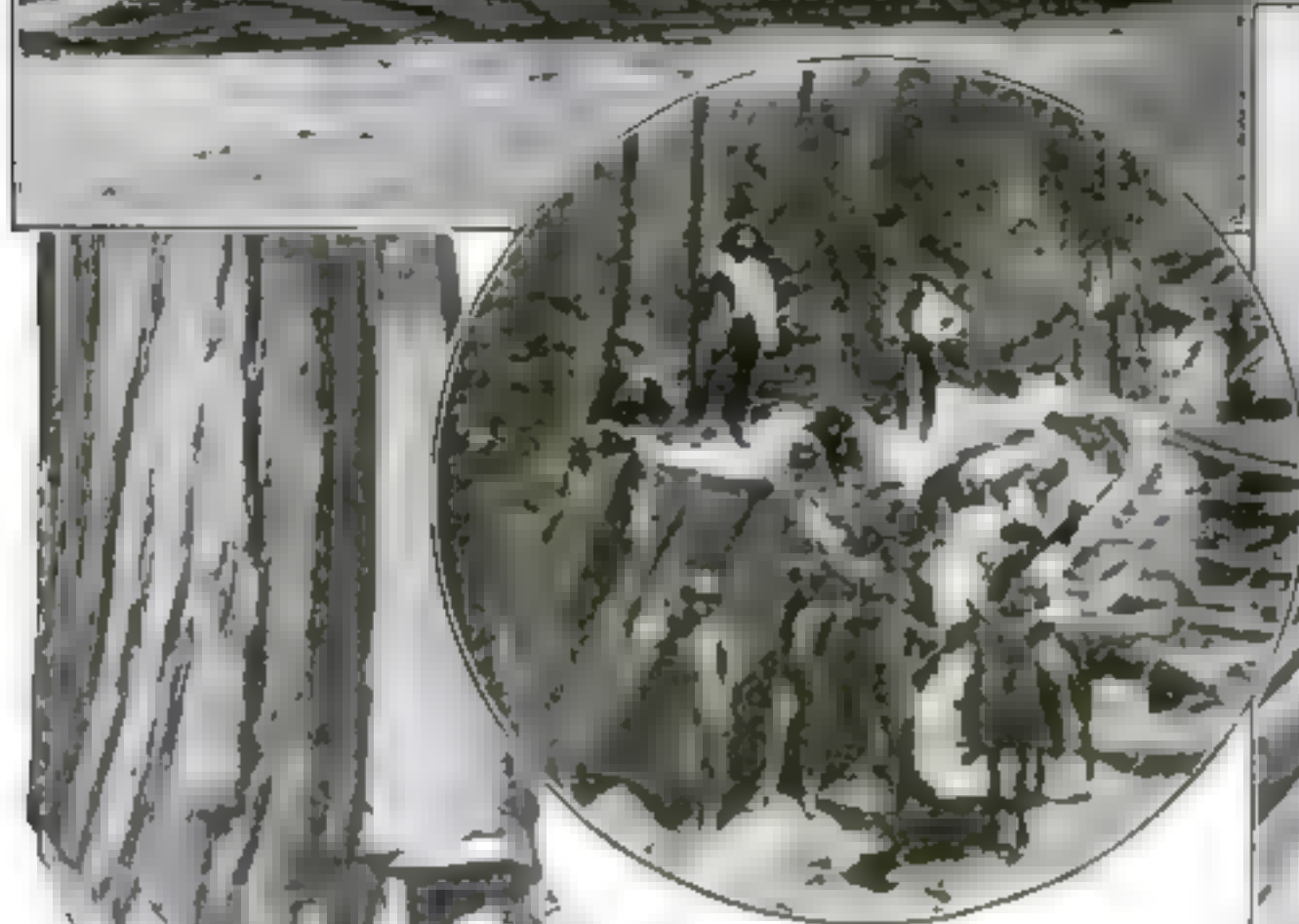
# Where the Big Trees Crash Down

## The Mechanics of Lumbering—A Dramatic Story in Pictures



### Largest Timber Raft

Large scale operations by which the best of our forests are protected here. The timber raft at the left is said to have been the largest ever constructed, containing more than 5,000,000 feet of logs. It was towed 1000 miles from the Columbia Ore. to San Diego, Cal.



### Starting for the Mill

After the Columbia log trees are cut, they are cut into smaller logs for transportation to the sawmill. This log, which has started for the mill, is subject to fire in the water.



### A Raft 720 Feet Long

This long raft of Douglas fir, which is being towed down the Columbia River at St. Louis, Wash., is 720 feet long. The logs, piled by the handle, form an immense barge.

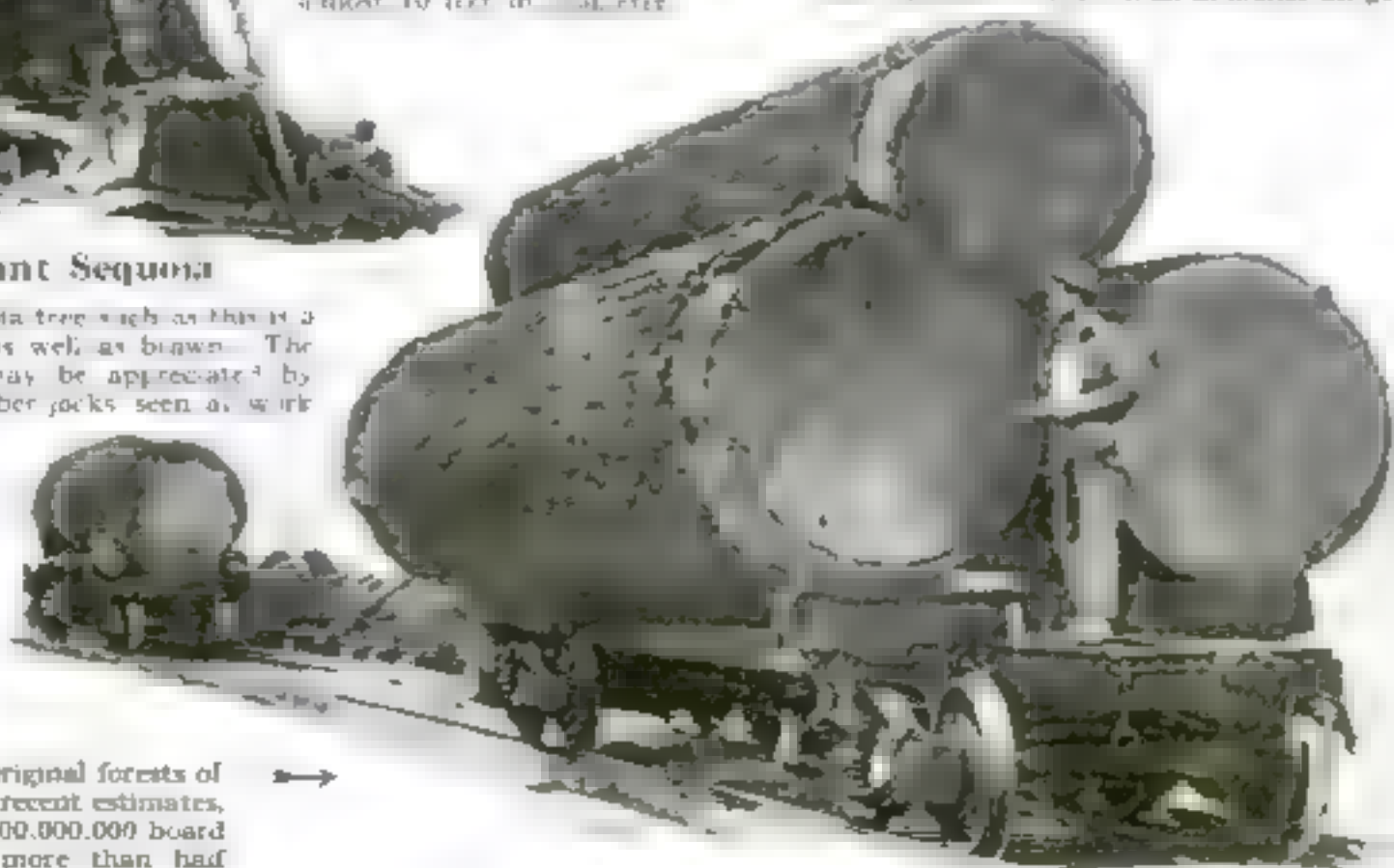


### The End of a Giant Sequoia

Felling a giant California sequoia tree such as this is a task that requires great skill as well as brawn. The enormous girth of this tree may be appreciated by comparison with the two timber jacks seen at work.

### From Forest to Mill

Piled on flat cars, these great logs are shown on their way from Washington forests to the sawmill. So the big trees are disappearing rapidly. The original forests of the United States, according to recent estimates, have been reduced from 5,200,000,000,000 board feet to 2,200,000,000,000, or more than half.





# The "Missing Link" at Last?

Discovery of ape-man's skull may prove theory that Africa is the birthplace of man—New contributions to science

**I**N THOUSANDS of research laboratories, in countless shops, in the fields, forests, mines—even in the farthest corners of the earth—the workers of science are on the job every day for you. The volume of their achievements in making your life more enjoyable and freer from the sufferings of want and

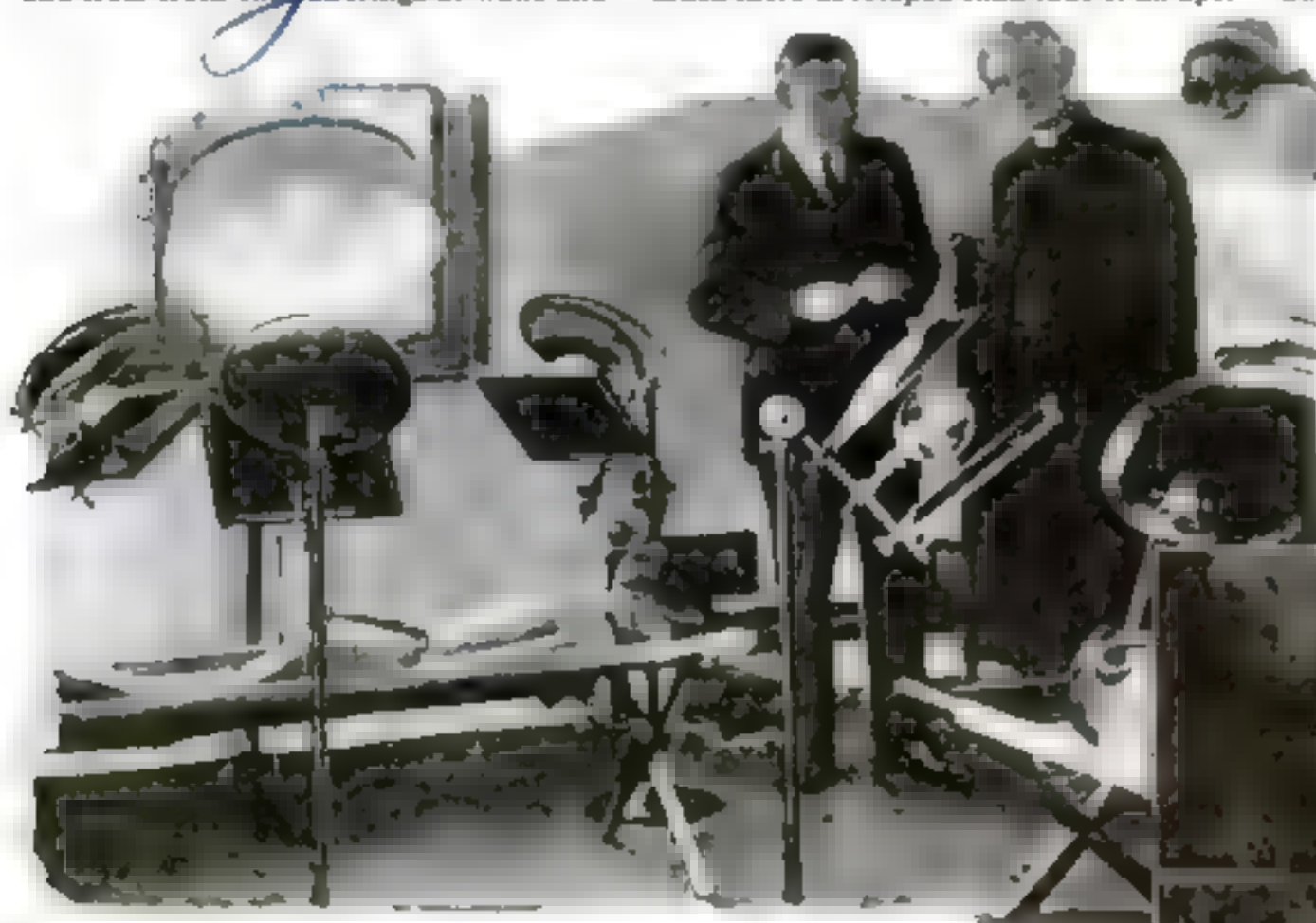
poverty is beyond counting. The Pithecanthropus, the oldest man known, from the shape of a skull found, is judged to have been a creature who could speak. Judging again from the shape of its skull, Professor Dart says that the newly discovered manlike ape could not yet speak, but had a brain much more developed than that of an ape.

male or female and was destined to remain so throughout life.

Recently, though, Dr. Oscar Riddle, of Carnegie Institution, Washington, D. C., suggested that this belief in the unalterable fixity of sex is open to question.

Some years ago a female pigeon in the Carnegie Institution's laboratory at Cold Spring Harbor, N. Y., developed a disease that caused the degeneration of its sex gland, female birds having but one. This gland was on the left side of the pigeon's body. In a short time a male gland began to develop on the right side of the bird, and before long the pigeon actually had turned into a male.

Experiments performed by Doctor Riddle and others on other pigeons indicated that the sex of birds might be changed more or less readily. It was noted, more-



Natural and Artificial Sunlight Combined in New Treatment

The beneficial effect of ultra-violet rays, or artificial sunlight, in the prevention of disease—especially of rickets among children—has been demonstrated repeatedly by American and European scientists during the last year. Now the U. S. Bureau of Standards has determined by tests just completed that as a germ-killer the ultra-violet ray acts almost instantaneously. Bacteria of the kind found in sewage were killed in less than a second after exposure to the rays. The above photograph shows Dr. Murray Levick, a British pioneer in the use of sunlight for healing, demonstrating his new apparatus for combining natural and artificial sun rays in the treatment of children. Note how reflectors are placed above the patient.

disease is far beyond recording. Some of them remain forever unknown to fame.

On these pages are simply a few of the month's most important contributions to the world's useful scientific knowledge.

## Ape-Man's Skull Found

**D**ESCRIBED as the long sought "missing link," a skull found recently at Taung in South Africa, is considered by some scientists as the most important anthropological discovery ever made. The skull is that of a creature with an intelligence rated between that of a man and an ape, filling in the important gap that so long has proved a stumbling-block in the explanation of evolution.

Professor Raymond Dart, the noted Australian scientist, who found the skull in a limestone mine, has named the creature linking man with apes, "Australopithecus Africanus."

The difference between men and animals is associated with the size of certain

parts of the brain. The brain was enlarged in those parts associated with human characteristics.

The skeleton remains consist of two fragments. One is a brain cast, which is complete and whole. The other is the face of the skull, which was found completely embedded in the limestone of an old cavern.

An interesting feature is that the discovery seems to support Darwin's belief that Africa was probably the original home of the human family.

## Can Sex Change?

**S**CIENCE always has held that sex was a matter determined at the very beginning of life by certain cell structures known as chromosomes, that long before birth the expected arrival was fated to be either



Mammoth Flower Shows Amazing Growth

Studying the amazing growth of this titanic flower called *Anemone*, botanists recently discovered that it reaches its height of about four to a little more than a foot. The plant is a native of Sumatra. When the flower is full-blown, it has an extremely unpleasant smell. Its full magnificence lasts for only three days, when it collapses. The photograph is reproduced by courtesy of Mr. P. [Name], who is curator of the Botanical Gardens at Buitenzorg, Java.



over that male glands developed on the right side much more than on the left.

From these experiments sex changes have been brought about long after birth. Doctor Riddle suggests not only that the sex of an animal may not be the unchangeable thing it always was believed to be, but that, depending on the sex, the degree of sexuality is greater on one side of the body than on the other.

Supporting this new suggestion that the difference between the sexes actually hangs on a most slender thread are experiments recently conducted by Prof. Frank R. Lillie at the University of Chicago. By a simple gland operation, performed on several hens when young, he has caused them to acquire virtually all the characteristics of male birds.

## New Antiseptic Stronger than Carbolic Acid

**M**EDICAL men long have dreamed of discovering some universal antiseptic which, taken internally, would destroy all the disease germs in the body, providing virtually a panacea for human diseases. Now this dream seems closer to fulfillment with the recent development of a marvelous germicide, said to be 50 times more powerful than carbolic acid, yet so harmless that quantities of it may be swallowed without injury.

The discoverer of the new antiseptic, called "hexylresorcinol," is Dr. Veeder Leonard, Chairman of the Clinical Committee on Antiseptics of the National Research Council. He and his associates spent 10 years in developing it in the Johns Hopkins School of Hygiene and Public Health, Baltimore, Md.

In the experiments the antiseptic was first fed to rabbits. When the animals suffered no ill effects, Doctor Leonard and the six men working with him took it in increasing doses, and eventually were convinced that it was harmless. It was then that hexylresorcinol was successfully applied at Johns Hopkins Hospital for the treatment of patients suffering from infections of the kidneys and of the urinary tract. In some cases, kidney infections of long standing were cleared up in 48 hours, according to the hospital records. The cures appeared to be permanent, it was said.

To determine just how far-reaching may be the application of hexylresorcinol to disease in general, a committee of 16 scientists has been appointed by the National Research Council to work with Doctor Leonard in further research.



Steel Tested by Flying Sparks from the Grindstone

Photographs of sparks flying from a grindstone are employed in a new and exact method of testing steel invented by E. Pilon, a French mechanical engineer. By this method he claims even the amateur can determine the degree of hardness and purity.

Sparks are photographed on a black background at very close range, and the images thus obtained are enlarged, revealing distinguishing formations that are said to determine the metal's quality. The pictures show the new apparatus and spark photographs.

## Niagara's Wasted Power

**T**WO and a half million horsepower are constantly going to waste at Niagara Falls, according to a report made re-

cently by Samuel S. Wyer, associate in mineral technology of the Smithsonian Institution. This represents 87,800 cubic feet of water, which flows over the falls every second and which might be diverted for power purposes, he states, without marring the scenic beauty of the falls.

The total volume of water flowing over the American and Canadian Falls is 206,000 cubic feet a second, of which 94 per cent is carried by the Canadian side. At present 56,000 feet is diverted for water power and 11,200 cubic feet feeds the Chicago Drainage Canal, the Welland Ship Canal, and the New York State Barge Canal. This leaves 137,800 cubic feet, of which, Mr. Wyer maintains, only 50,000 is needed for scenic beauty. The remainder, he states, may be "harnessed."

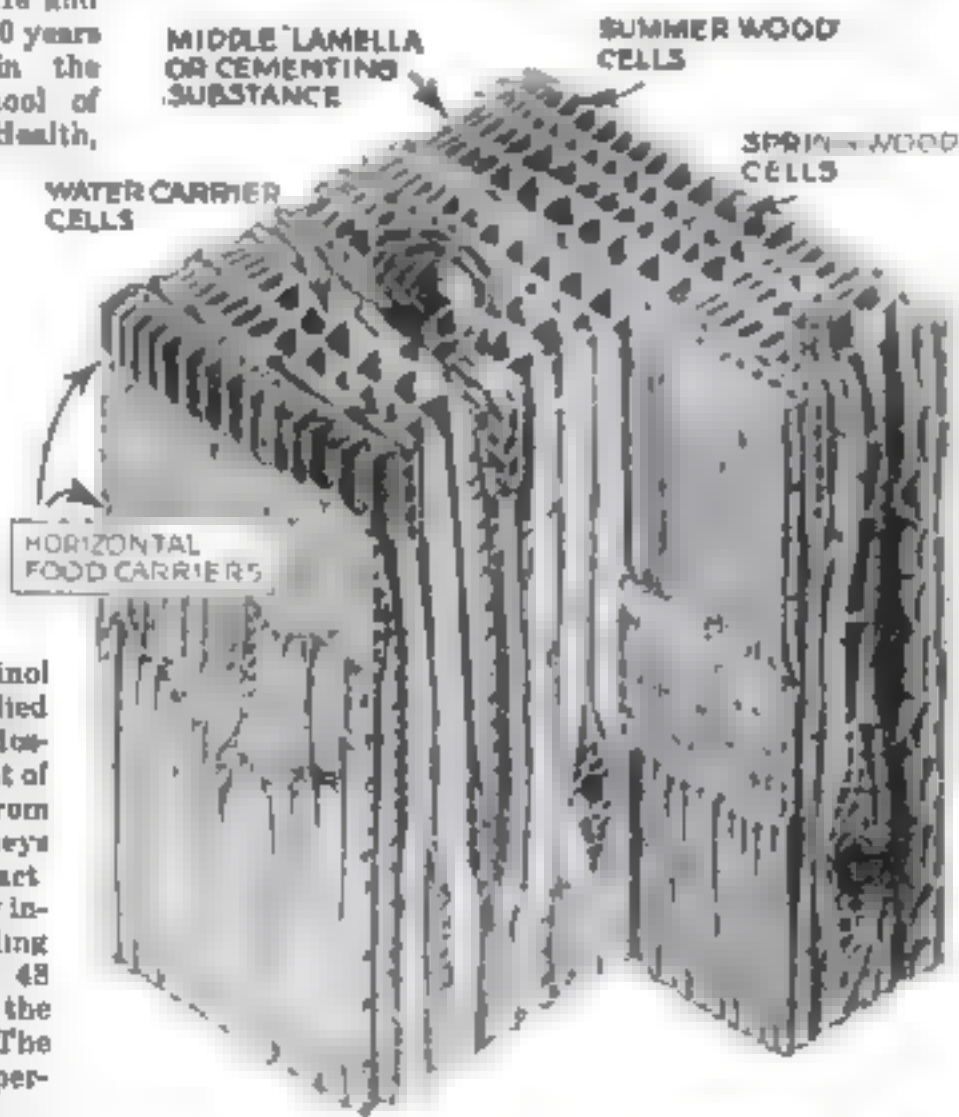
Further water-power projects at Niagara Falls are impossible under the present treaty with Canada, which limits the amount of water that can be diverted for this purpose to 56,000 cubic feet, producing about 1,000,000 horsepower.

## The Work Your Eyes Do

**M**OST of us realize the importance of good eyesight; few, though, probably know to what extent we employ our vision in our daily work. In a recent test conducted by a commercial concern studying problems in illumination it was determined that the ordinary run of indoor workers—clerks, machinists, printers and the like—use their eyes 70 per cent of the time they are at work.

Among 20 occupations that may be classed as "close work" it was found that in only six did the necessity for close visual application fall below 50 per cent of the working day.

The object of this eyesight test was to determine how much the production of workers may be increased by better illumination without placing an undue tax on their eyes.



## Secrets of Wood Disclosed by Microscope

This remarkable diagram of the cell structure of a block of white pine wood, recently produced with the aid of a microscope, reveals that wood instead of being a solid mass is really composed of many tubular cells (tracheids) which are water carriers. The vertical cells which are water carriers are the bulk of the wood substance. Running at right angles to these are horizontal cells that act as carriers of food material. Spring wood cells that form during the early growing season and summer wood cells that form toward the end of the season, together form one of the annual rings by which the age of the tree is told.



# Ten New Inventions for

## Pocket Check Protector

A CHECK protector, small enough to be carried in the vest pocket, is a recent invention for the convenience of business men who are careful to prevent raising of their checks. It includes all the numbers needed, the cipher and the dollar sign. There is an ink pad between the lower and upper plates.

When a check is inserted and the protector pressed, fine sharp pins prick holes in the check and these are filled with fluid from the pad. Any pressure on this inked number can be detected easily. For additional protection specially designed figures can be used on the device.



The protector perforates check and fills holes with ink

## Rural Mailbox Stand Revolves

A REVOLVING metal stand, holding from two to 12 mailboxes, saves space and time for the postman delivering rural mail near Livermore, Calif.

In order to do away with unsightly rows of individual mailboxes set on posts at crossroads, groups of farmers in many communities fix their mailboxes to large discarded car wheels set on the ends of fence posts. The newly invented metal stand serves the same purpose and helps to keep the highway more attractive.

The sides of the device can be used for posting small local notices. Mounted at the top is the center post over which the supporting frame revolves. A small hand sign in the form of an arrow



## Inflated Safety Belt for Bathers Fits Tightly

WHEN TAKING a summer swim a person is often in danger. This inflated safety belt for bathers fits snugly around the chest and stays inflated through the swim. It has four large air chambers, two in front and two in back, with vulcanized seams.

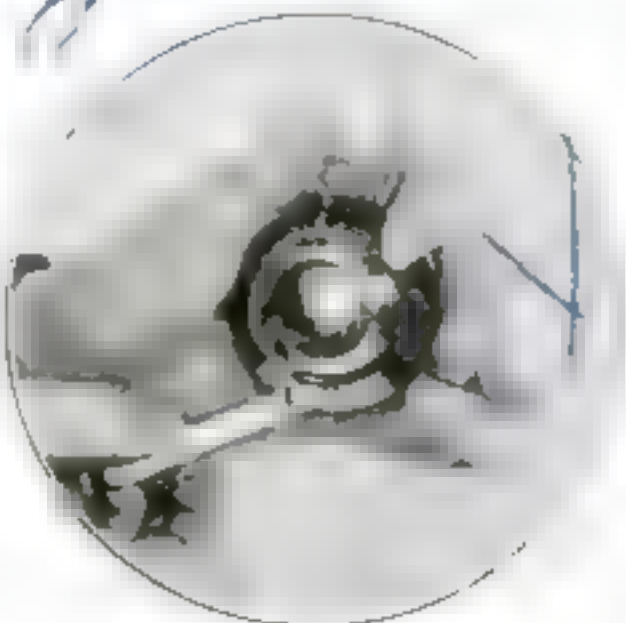
Once adjusted, it cannot come loose, the manufacturers claim, and it interferes in no way with the movements of the bather. An air valve controls the inflation.

AN ELECTRICAL process for manufacturing carbon black, a pigment widely used for such purposes as printer's ink and carbon paper, recently has been devised by the U. S. Bureau of Mines. The present process uses natural gas.

## This Novel Fire Alarm Rings the Door-Bell

ONE of the latest fire-alarm devices is connected with the electric door-bell circuit of a house, so that if a fire starts, it sends out a warning by ringing the bell.

In the photograph below the alarm is being tested with a lighted cigarette. Within from 30 to 60 seconds after the heat is applied the inventor claims it will start the door-bell ringing.



A cigarette sets off the fire alarm

## New Voltage Tester Tells the Kind of Current

TO TELL whether an electric current is alternating or direct, as well as to measure its voltage, this new type of voltage tester has been designed. It does

the thing in the use of the new type of voltage tester. The



Testing voltage from a light socket

apparatus is inclosed in a rugged fiber housing.

A magnet coil operates a plunger against the tension of a spiral spring. The position of this plunger on a scale indicates the voltage. Pointed hooks in fiber-insulated handles at the end of long wires make it easy to get the lead wires into the circuit.

The photograph shows the device being used to test the current from an ordinary electric-light socket.



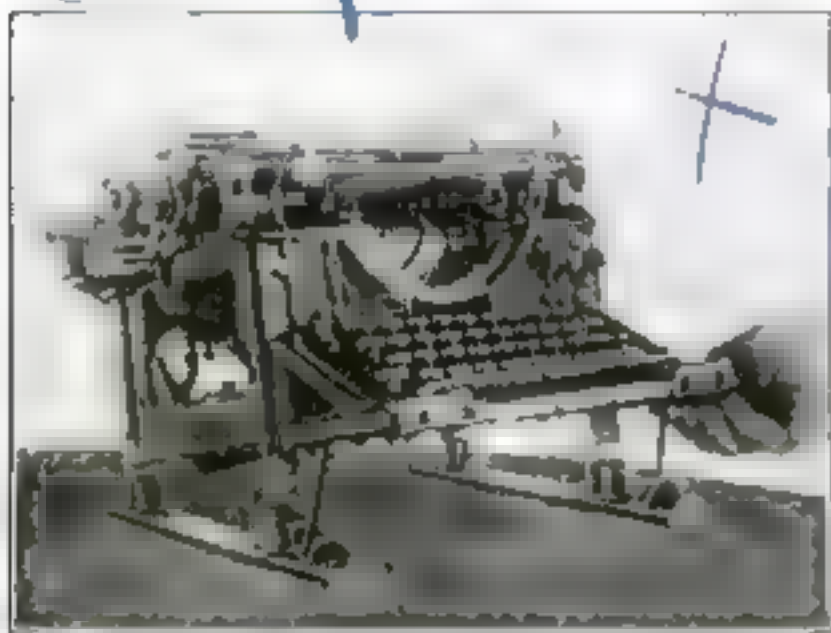
# Our Every-Day Use

## Typewriters Silenced

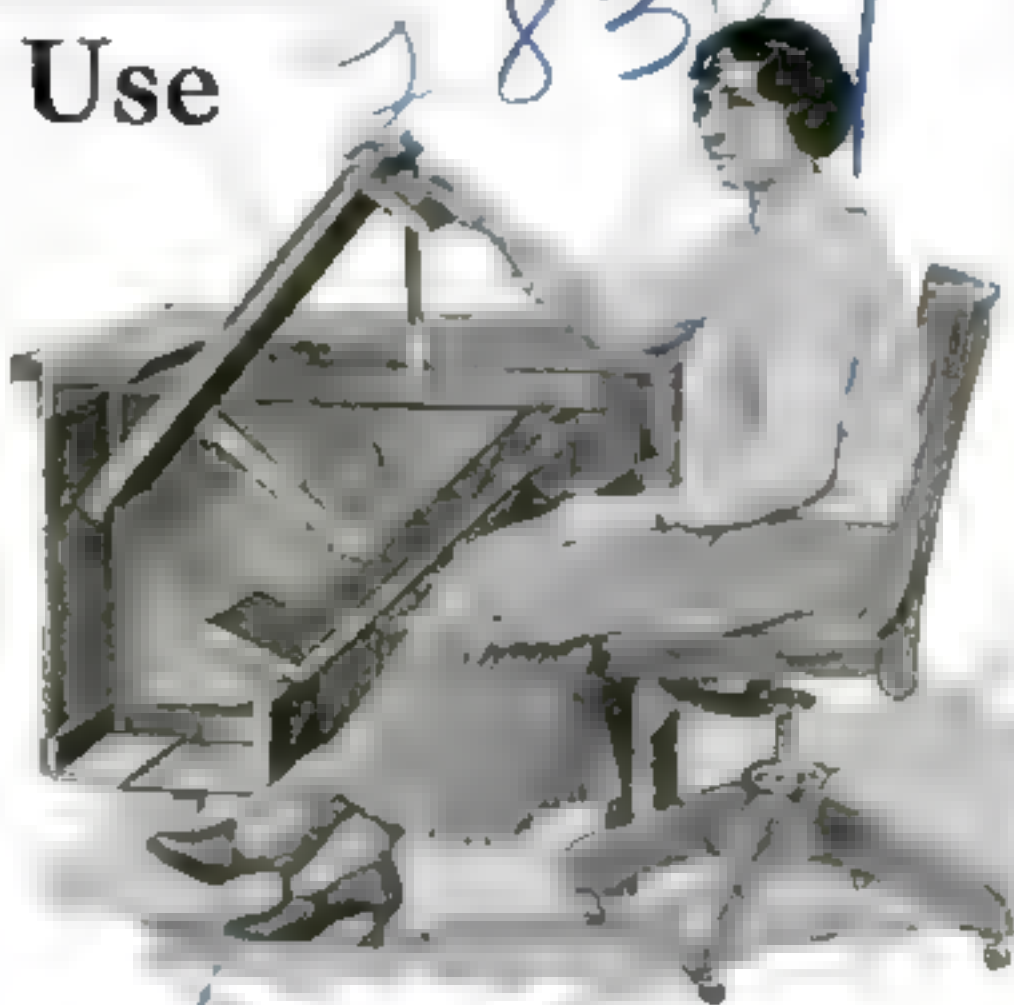
**T**YPEWRITERS fastened to desks with newly invented shock-absorbing attachments are said to become practically noiseless and rattle-proof, thus saving wear on the machine as well as on the nerves of office workers.

The rubber feet of the typewriter fit into sockets of the attachment, which is a rest and covered with springs. The attachment is actuated by automatic locks that engage the frame as the legs are inserted. The sockets are released simply by pressing up the frame.

Parts of the machine remain accessible for setting or repair.



How the typewriter legs rest on four shock absorbers



## A Push Opens New Typewriter Desk

**A** SLIGHT push brings the platform of this new typewriter desk into position. The lid is raised halfway before the typewriter platform moves, then a straight push backward brings the typewriter into place, making the operation easier and simpler, it is claimed, than that of the ordinary drop-head typewriter desk. The platform locks automatically into position.

Rigid supports prevent the platform from shaking, and ample knee room is provided for the operator, whether the desk is open or closed.

## Special Pen Marks Packing Cases with Ink

**A**DRESSES and marks made with a pen or pencil on packing cases and boxes often rub off so that they are illegible. Much more permanent marks may be put on with ink. It is claimed, with a special pen invented recently for that purpose.



The marking pen is held upright

The flow of ink depends upon the pressure on the rubber nib. Any good ink may be used. The writer uses it like an ordinary pen, but holds it a little straighter. The pen can be used, also, for writing display cards or window signs.

A JOURNEYMAN baker in Paris, France, claims to have discovered a formula for bread dough that will keep the loaves in edible condition for months or even for years.

MAKING synthetic rubber has resulted recently in the discovery of a synthetic chemical substitute for cocaine. Tuto-kain, the new compound, is made from the intermediate products. It is said to be effective as a local anesthetic.

## Self-Feeding Brush Aids in Cleaning Type

**T**O DO away with the rather mummy method of cleaning typewriter type with brush and pin, a self-feeding typewriter brush has been designed. It consists of a hollow metal handle containing type-cleaning fluid, which is fed into an adjustable bristle brush. The fluid is applied by pressing a pump button.



A typewriter brush shaped like a pencil



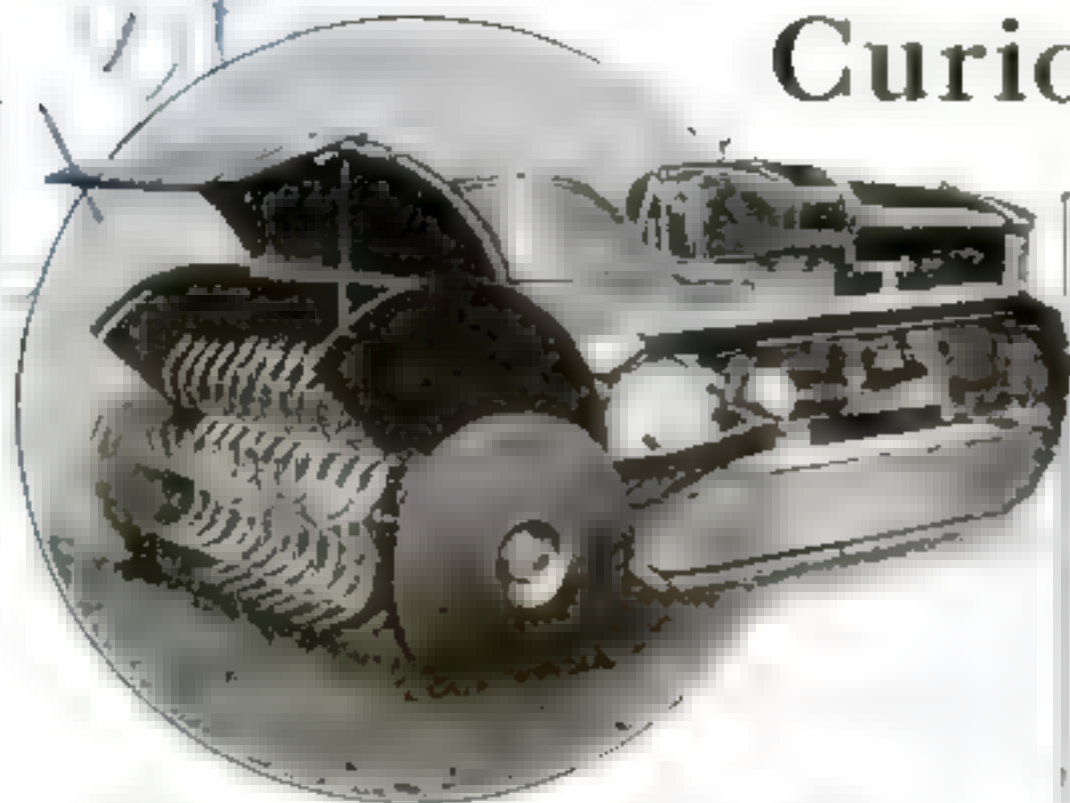
## Combination Lock Invented for House Doors

**T**HIS ingenious door lock works like the combination of a safe. The key is inserted permanently in the lock, which has a set of buttons around its outer edge. It can be turned only when the proper set of buttons has been depressed.

To bring the buttons back to their original position, the key is pulled outward after the door is opened, and the lock is again ready for service.

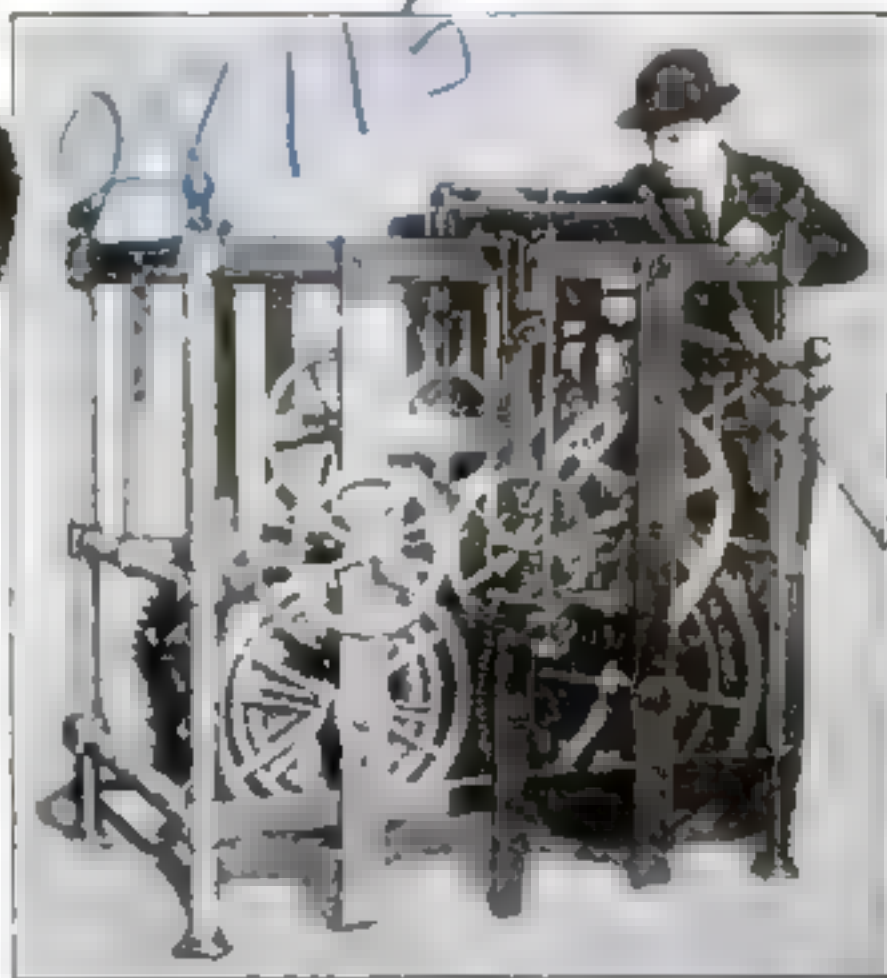


# Curious, Useful and



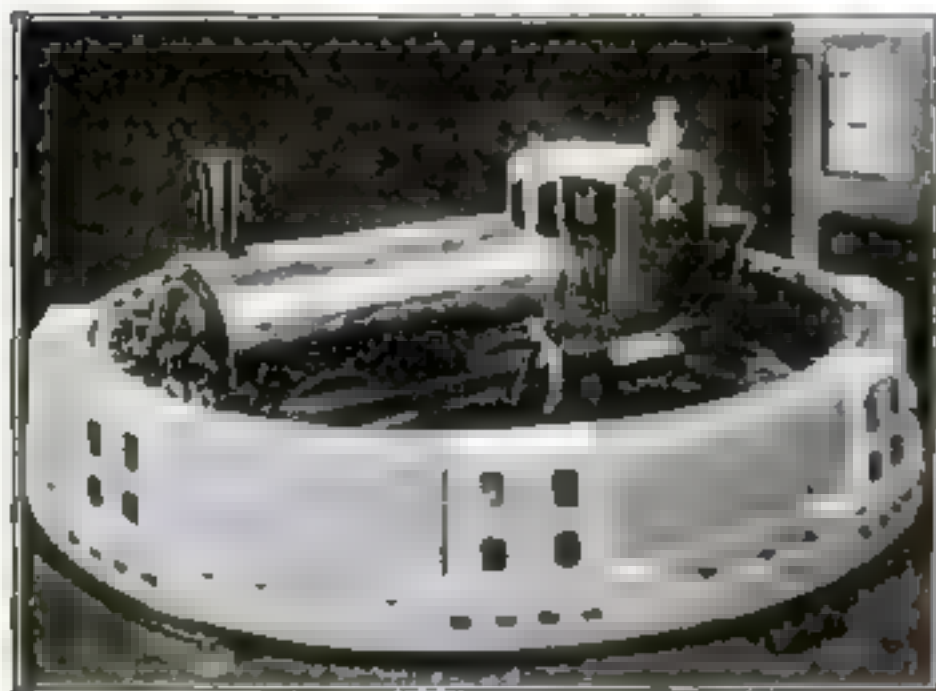
## Caterpillar Tractor and Plow Combined

One of the most compact farm implements exhibited at a recent German exhibition was this tank-like plow, said to be the first machine to combine caterpillar traction with plowing.



## These Wheels Have Run Nearly a Century

For nearly a century these clock wheels have been keeping good time. The clock was built in 1837 by Isaac Quincy Loomis and has many interesting features. It is in the possession of the Philadelphia Museum. It was remounted recently in the attractive new town hall at Germantown, Pa.



## Mammoth Dynamos for Russia

There is room for a fair of 2,000-horsepower engine within the shell of one of the new generators. It is a supply for the city of Leningrad, Russia, with an output of 11,000 kilowatts. These have been ordered by the Swedish General Electric Company.

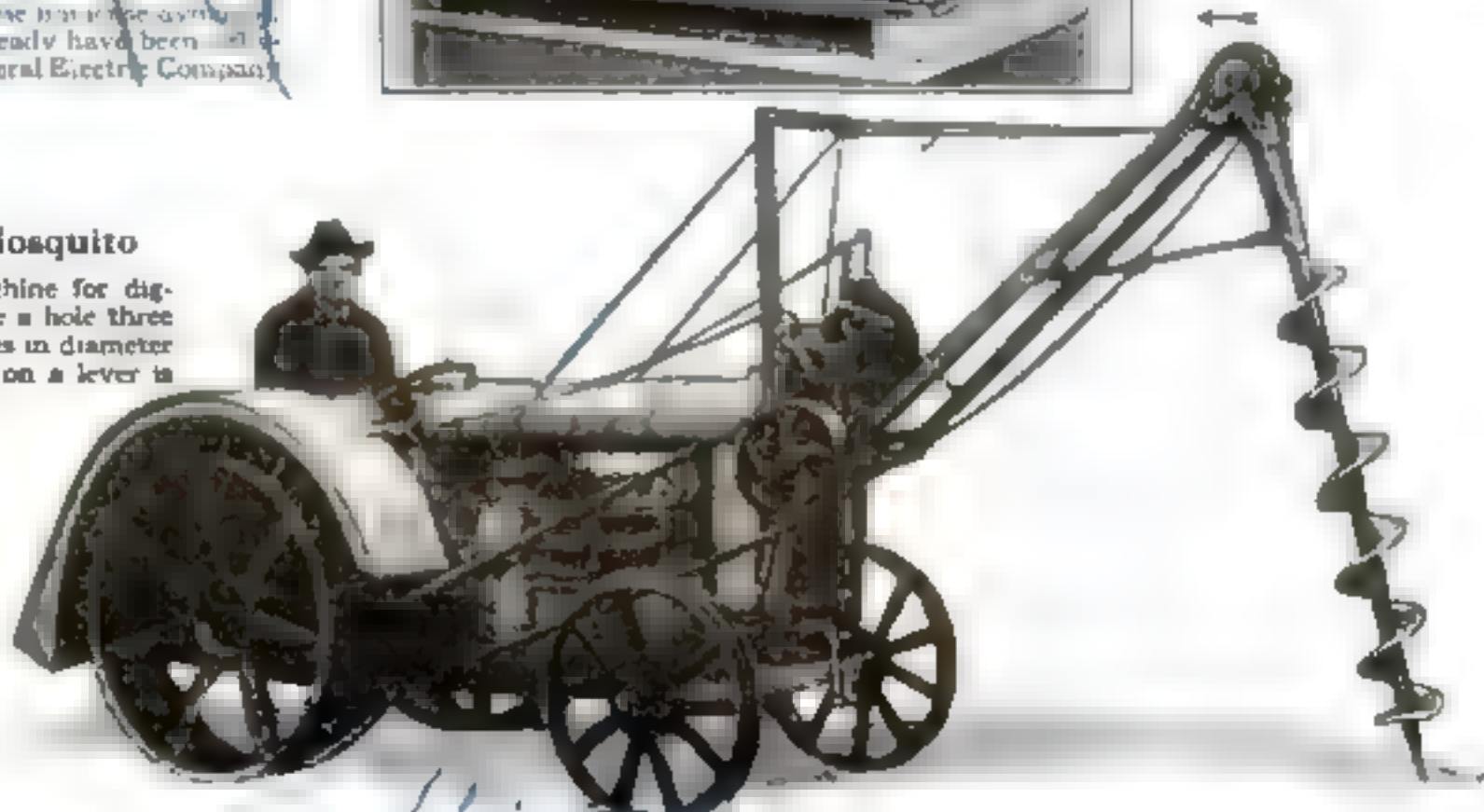


## A Machine that "Thinks"

If you ever have tried to solve an arithmetic problem, you will appreciate the complexity of a new machine that keeps its own record of each step in its calculations. It is a type of early computer.

## Like a Huge Mosquito

A remarkable new machine for digging post holes can bore a hole three feet deep and nine inches in diameter in 30 seconds. A pull on a lever is sufficient to start the drill downward. Another pull stops it at the desired depth and brings it back to the starting point. The inventor, Otto Coil, of Washington Court House, Ohio, built his original model from 23 pieces of farm machinery.

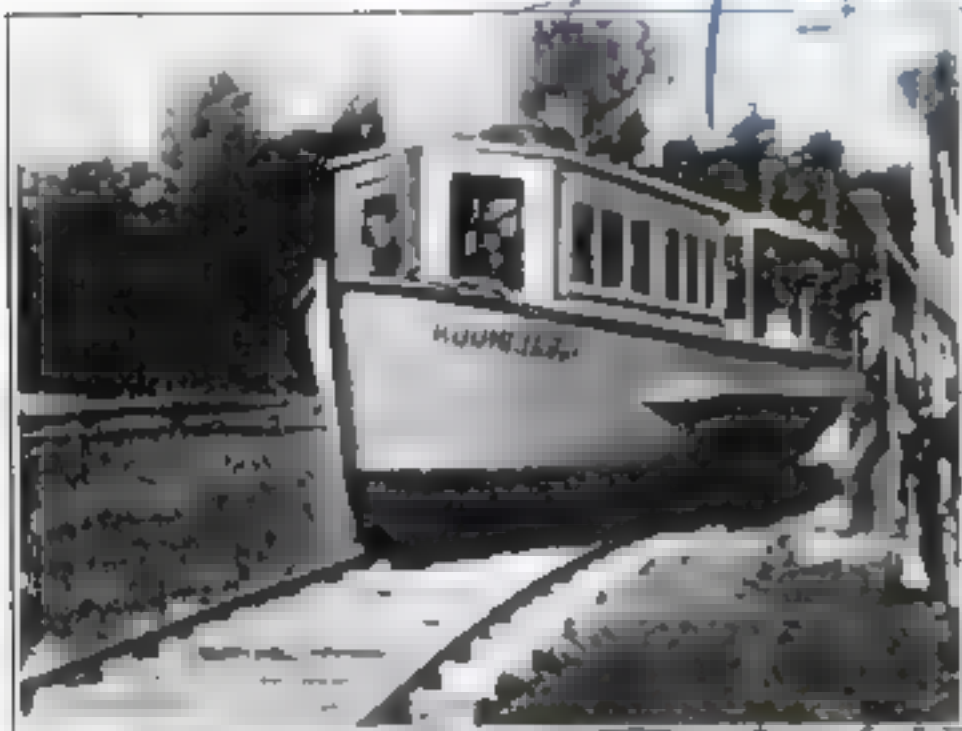




# Ingenious Machines



971503



## Boat Runs on Rails

One of the world's queerest boats, when it reaches land, climbs out of the water on rails and propels itself like a train on a track to its dock many feet from the shore line. It launches itself in a similar manner. This strange land-water craft is in daily service at Helsingfors, Finland.

## Automatic Potato Digger

An improved labor-saving machine for the farm is a mechanical potato digger equipped with a revolving automatic dump that discharges the potatoes in windrows, convenient for the pickers to put in baskets. Side and rear views are shown in the illustrations above.



## Vacuums Streets

The most modern of street-cleaning methods now is being applied to sweeping city streets. This mammoth vacuum cleaner recently invented, sucks up litter without raising dust, and sweeps without water.

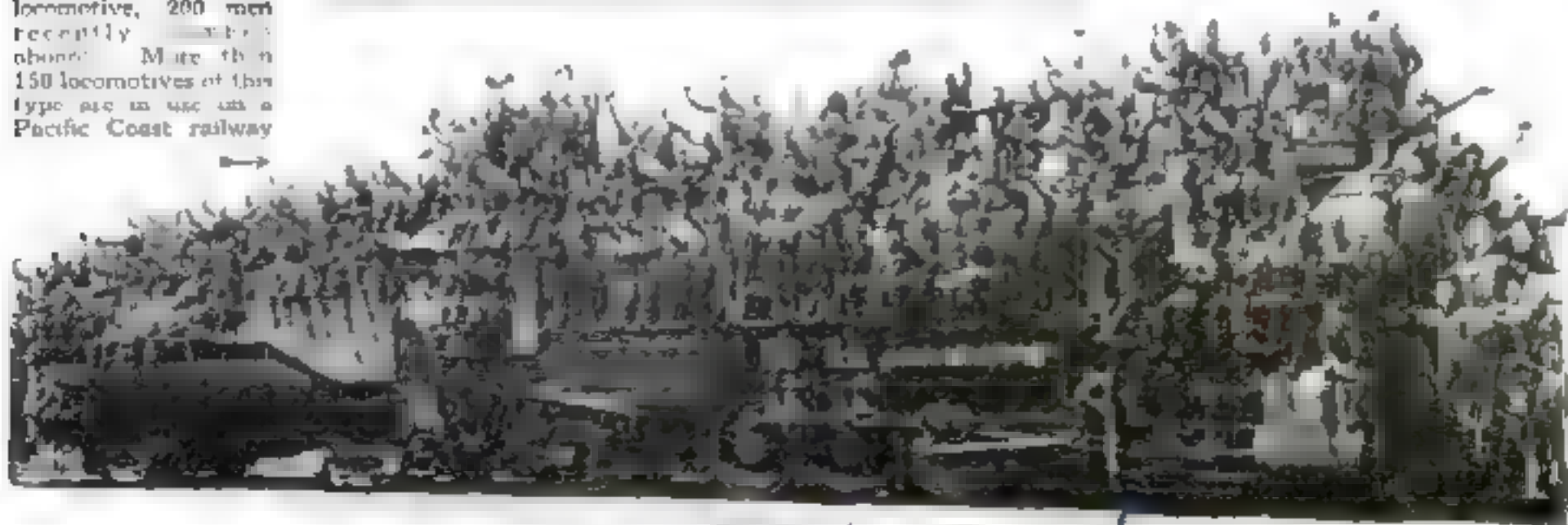
## 200 Aboard

Just to demonstrate the immense proportions of a powerful new type of mountain locomotive, 200 men recently boarded it. More than 150 locomotives of this type are in use on a Pacific Coast railway.



## Gasoline Locomotive

For heavy duty hauling service such as is required for mines, bulk goods, and construction jobs, an economical gasoline locomotive a tractor on rails has been perfected. It consumes about five gallons of gasoline a day.



26131



## Electric Handsaw Has Many Uses



A carpenter using the electric saw on the job

A NEW portable electric circular saw enables workmen to do power sawing on the job with speed and accuracy. It is said to cut satisfactorily wood, wallboard, plaster board, fiber, linoleum, hard rubber, insulated cables, brass, and many other materials. It can be used also in the packing industry for cutting meat.

Since the body of the saw is of aluminum the tool is light in weight and easy to handle. It has a cutting capacity of two inches in hard wood and has attachments to be used for beveling or other similar purposes.

The air-cooled motor is placed directly back of the saw. This runs only while the operator holds his finger on a contact

trigger switch in the handle of the tool. A guide in front of the saw enables it to cut on the line straight and clean, eliminating costly trimming operations. The tool can be run from a wall socket.

A NEW combination plier and wrench designed for many uses, can grip anything, from a cotter-pin to a nut on a three-quarter-inch bolt.

## New Polishing Tool Has Inflated Wheel

A PNEUMATIC wheel for grinding, buffing, and polishing, designed to speed up work along these lines, has just been put on the market. The wheel is inflated by means of a valve, just as an auto tire is inflated. The grinding surface is removable.

Sandpaper, emery, or any other abrasive surface can be attached to suit the convenience of the user. The grinding strips are held by a flange.

The operator pushes the tool along the surface of the work exactly as a plane is manipulated, the wheel being motor-driven.



## Handy Pocket Screwdriver Has Folding Blades

NEXT to a knife, a man finds himself more often in need of a screwdriver, probably than of any other tool used for ordinary purposes.

A Michigan manufacturer recently has developed a folding screwdriver that can be carried in the pocket with one's knife. Three blades of different sizes lock open separately, giving the compact tool a wide range of usefulness. When the blades are not in use, they are locked tight in the handle.



## Finds Way to Store Surplus Steam for Future Use

A SIMPLE device that enables surplus steam produced during slack hours to be stored in a reservoir until the time of peak load brings a need for it, has been devised by a Swedish engineer, Dr. Johannes Ruths.

In recognition of his valuable invention, the Swedish Academy of Engineering Science awarded the inventor a gold medal.

The steam accumulator is a large cylindrical tank with spherical ends, filled with water to 90 or 95 per cent of its capacity. Steam not needed at the moment for the engines is passed into the remaining space, where under the pressure it condenses to superheated water. Later, when more steam is needed than the boilers can supply, the water level in the tank is lowered decreasing the pressure, and releasing the steam. Loss of temperature is prevented by a heat-insulating wall built about the tank.

## Automatic Machine Saves Time and Labor in Truck Loading

WHILE only one man is needed to drive a delivery truck when heavy merchandise is carried, an additional man is required to load or unload it. Double expense therefore is incurred on trucking jobs, merely for the few minutes when loading or unloading is done. For some time manufacturers have been looking for a mechanical aid, so that material could be lifted into truck bodies by the driver.

A German engineer recently invented the automatic truck loader for barrels shown in the photograph. With this, it is said, one man easily can do the work of unloading or loading.

The device consists of a V-shaped tilting platform that slides up and down an inclined track lowered from the rear of the truck. This platform, or carrier, is operated by a hand winch on the side of the truck.

When a barrel is to be unloaded, it is rolled from the floor of the truck to the platform. Lowered to the bottom of the incline, the platform encounters a stop

that automatically tilts it in such a way as to discharge the barrel to the ground.

In loading, the operation is reversed, the barrel being rolled on the platform from the ground and pulled up the incline.

While the larger photograph shows two

men at work unloading barrels from a truck, it is quite apparent that the device would enable one man to handle the heaviest loads unaided.



Four heavy barrels are discharged from a truck. The view at the left shows a barrel being rolled on the platform which is lowered down the inclined track. At the bottom (above) the platform is tilted, thus discharging the load.



## New Radio Wrench Spins Round Nuts Tight

ONE of the chief sources of trouble for the man who has to run a radio service in hinged connections. Small round nuts in almost inaccessible places are particularly difficult to tighten sufficiently to insure good, permanent contacts.



The newly designed wrench shown in the illustration has sharp teeth tapered so as to grip knurled round nuts firmly, with but slight pressure. The long reach of the shank makes the tool especially useful.

and the handle gives strong leverage. The shank is tooled from one piece of steel and hardened for constant service.

## Numbers Cylindrical Parts Automatically

AUTOMATIC numbering of cylindrical metal parts has been made available for machine-shops by the recent invention of a machine that also will stamp names and trade marks on the work at the same time that the numbering operation is performed.

The parts to be numbered are carried on a special holding fixture on the table to which the device is attached, and are rotated automatically into the correct position.

By ordinary changing of the numbers a hand lever is depressed to give the next highest number. The lever strikes a fixed point on the holding fixture, and automatically advances the numbering disc. This arrangement makes the device adaptable for serial numbering.

## Railway Ties Dated with a Brand

A BRANDING outfit to mark railway ties is a new aid in keeping railway tracks in good condition. Railway companies usually keep records of the year in which ties are laid by marking them with special marks. These are inspected at intervals, and the oldest ties replaced by new ones. The marks, however, often are knocked off and the record destroyed.

The new branding device burns into the ties the date on which they are laid. It consists of a metal plate with raised numerals indicating the month, day, and year in which the branding is done. This plate is attached to a handle and is heated by a small torch. It can be used also to brand tools and other equipment.

Gasoline is the fuel used in the small torch, which will operate from 1½ to four hours, depending upon the use to which it is put. With special attachments, the torch can be used for heating a soldering iron or for a blowtorch.



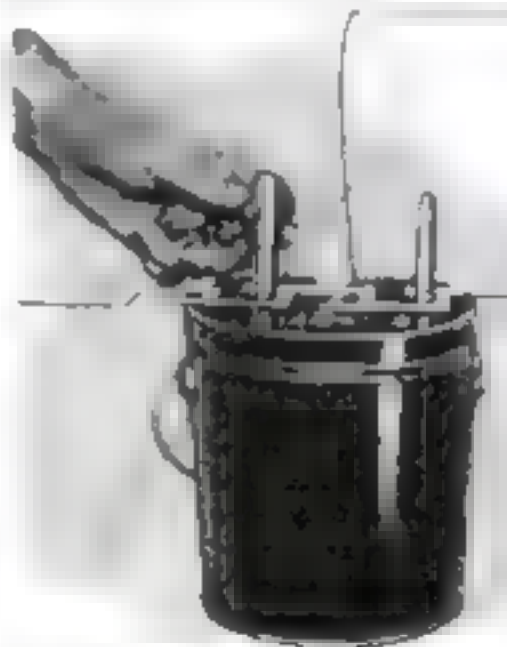
How the tool brands the date on a wooden surface

AN IMPORTANT advance in standardization has just been made in the adoption of standard screw threads by the American Engineering Standards Committee.

## Simple Rack Keeps Paint Brushes Pliable

IT IS a well known fact that paint brushes will last twice as long if they are properly cared for. To assist the professional painter, as well as the home worker, in keeping brushes in good working condition, the simple rack pictured at the left recently has been invented. It accommodates brushes of almost any size, suspending them in water or whatever other liquid is used to keep the brushes soft and pliable.

The rack rests on the container, no matter what its size or shape, and forms a series of slots in which the brush handles are held.



## With Powerful New Jack One Man Pulls a Steel Railway Car

FOR pulling and hoisting work, a powerful little machine called a "pulling-jack," recently invented can be used in an amazing number of ways. Operated by one man, it is said to be

proving a great labor-saver, especially in house-wrecking and on railways.

It is declared to be capable of moving anything weighing up to 100 tons. With

the jack one man can pull down a whole brick pier, a wall, or chimney, or carry the work of many men. In the photograph the jack is being used to pull a derailed steel railway car back on the rails. For stump-pulling and moving heavy machinery it is said by the manufacturers to be very efficient.

The machine combines the principles of the lifting jack and winch. A pawl-and-ratchet mechanism is used to wind a cable on a drum. The jack can be operated at six different speeds.

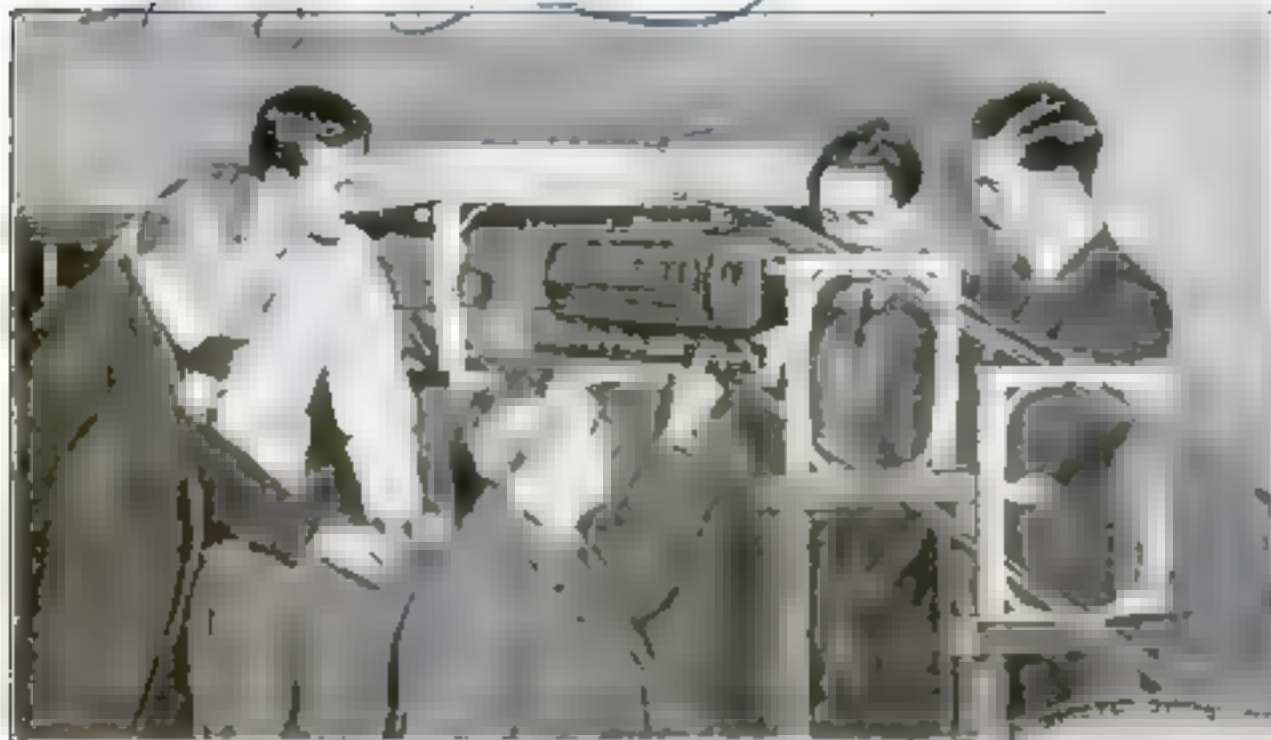
## Cleans the High Lights in Shops and Offices

TO FACILITATE the cleaning of electric-light fixtures and reflectors located far from the floor, a new brush mechanism attached to a long handle recently has been perfected. A lever at the side of the handle holds the brushes against the surface to be cleaned, and a hand crank revolves the brushes.

One man pulls a steel railway car with the aid of the jack







Demonstrating a model of the proposed high speed monorail subway. Emerging from the station the car dips down into a deep tube.

**A** HIGH-SPEED underground railway system in which cars running on a single rail could travel at the rate of 60 miles an hour, is the latest suggestion offered in England to solve the transit problems of large cities. A demonstration was given recently by means of working models by the inventor.

The proposed system would consist of stations just below the surface, connected

by deep tubes in which the cars would run on a single ground rail. They would be held upright by guide wheels running on a guide rail above. The wavelike course of the railway, the inventor believes, would serve to quicken the speed of the trains on departure and to retard them at the

## Monorail Subway Proposed in England

The inventor with a model of his monorail car. It is held upright on the single rail by guide wheels above the roof of the car.

approaches to a station. For maximum speed, as well as comfort, the inventor has designed special streamlined cars.

## Odd River Ferryboat Driven by Tractors

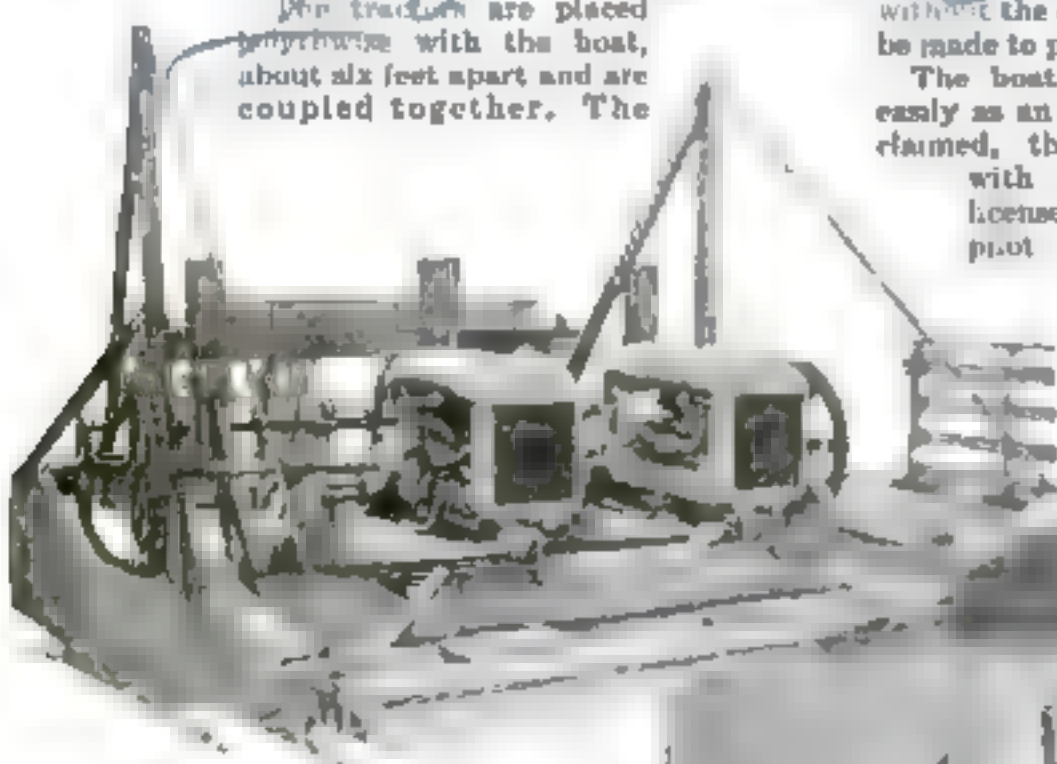
**I**N SPITE of old rivermen's prophecies that it couldn't be done, two Fordson tractors recently began operating on a regular schedule on the Tennessee River at Paducah, Ky. Engineers who have examined the project declare it power to be an improvement over steam for this purpose.

The tractors are placed endwise with the boat, about six feet apart and are coupled together. The

tractor shaft and axle are connected by a special device. By means of a special device the pilot can shift gears from his cabin. After the tractor engines have been started the pilot has full control, stopping them in neutral, reversing, or shifting to low and intermediate gears. The tractor can run without the other or both can be made to pull together.

The boat can be run as easily as an automobile, it is claimed, thus doing away with the need of licensed engineer and pilot.

How the two tractors are geared to the stern paddle wheel. They are controlled from the pilot's cabin.



## World's Greatest Tunnel

**T**HE greatest tunnel in the world soon will be built under the Mersey River in England to link the city of Liverpool with Birkenhead and adjacent towns on the south bank of the river. It will have an internal diameter of 44 feet, greater than the Hudson River tunnel now under construction.

The tube will contain two decks, one for automobiles, the other for streetcars.

## Novel Test Shows Strength of Bridge Railing

**A**FTER an accident in which part of the concrete balustrade of a bridge at Springfield, Mass., was knocked down, engineers made unique tests to determine its exact strength. They used levers consisting of wooden planks inclined at an angle, butted against the base of the railing. Ropes tied to the planks were attached to the top of the railing by means of hooks.

Sand was poured into weight boxes on the ends of the planks. The amount in these boxes when the railing fell determined the weight necessary to overturn the railing. Although the railing fell inward instead of into the river in the tests, the results were taken as holding for either direction.

The tests served to establish standards of strength for future bridge construction.



The novel tractor-driven ferryboat docked at Paducah, Ky., on the Tennessee River.





This photograph shows the spectacular illumination of Niagara Falls in 1907, which will be eclipsed by a more powerful system of searchlights.

## Niagara to Be Illuminated

**T**HIS spectacularly beautiful effect, the Illumination of Niagara Falls at night with searchlights, will be permanent after May 24. Twenty-four powerful searchlights, casting 1 1/3 billion candle-power, will be dedicated on that date, which is Queen Victoria's birthday.

Eighteen years ago the falls were lighted for 30 days, attracting thousands of spectators. The above photograph was taken at that time. In the new lighting of the falls, more powerful lights will be used, color screens and light drills sending beams that will be seen for 75 miles around.

## A Ship without a Rivet

**A**N OIL-TANKER in one piece, without a rivet in its hull plates or rivet in its steel frame, the first one ever built in the United States by the electric welding method, was launched recently in Providence, R. I.

Turbine heat generated by electricity fused together the sheets of steel and heavy plate iron in the tanker's frame.



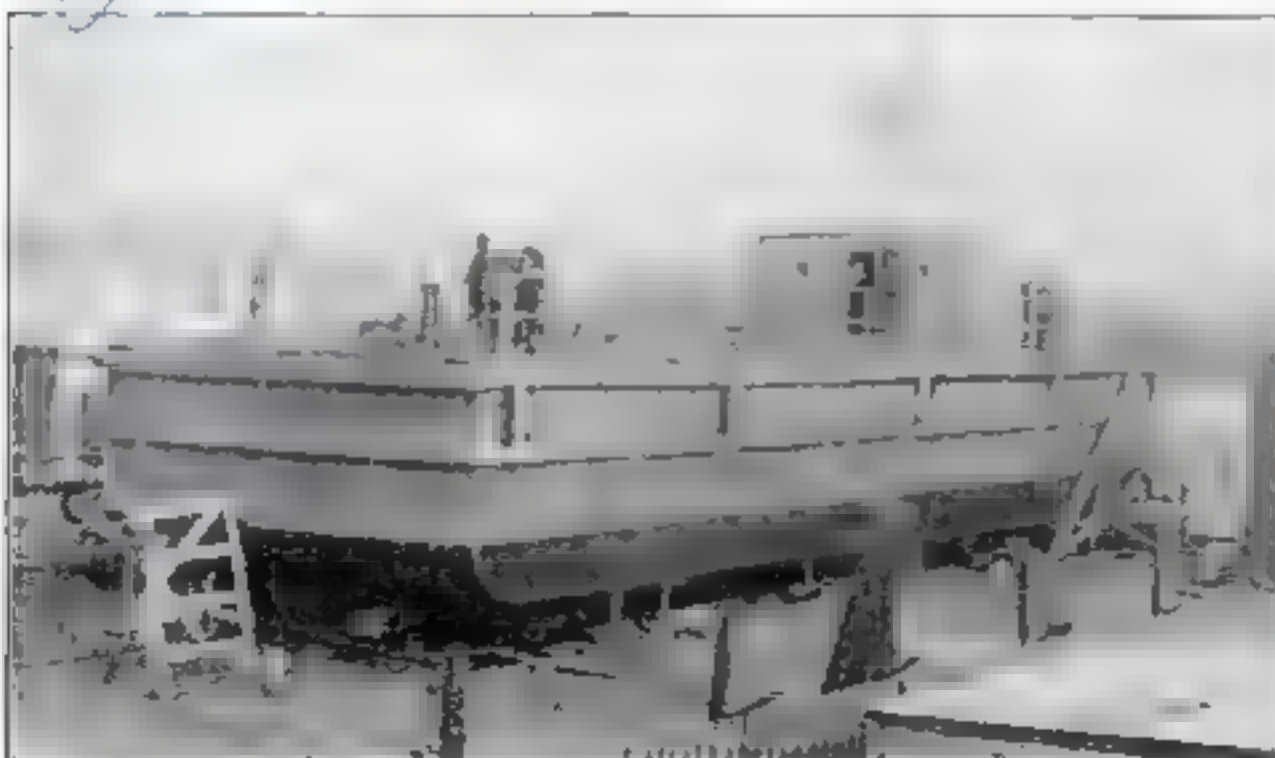
Projected chain of natural waterways along the eastern coast from Boston to Mexico.

## U. S. Plans to Link Chain of Coastal Waterways

**B**Y LINKING a long chain of natural waterways with canals a continuous channel eventually will be available along the eastern coast of the United States from Boston to the Mexican Gulf of Mexico. By far the greater part of this route is now open to vessels of limited draft. The entire route has been surveyed by U. S. naval engineers.

It is possible today to make the entire trip from Massachusetts to Florida with small craft without once going to sea.

The great system of canals that extends from New England to Florida is known collectively as the Atlantic Inter-coastal Waterway. When the work now in progress is complete, it will afford a continuous channel 12 feet in depth as far south as Beaufort, N. C.

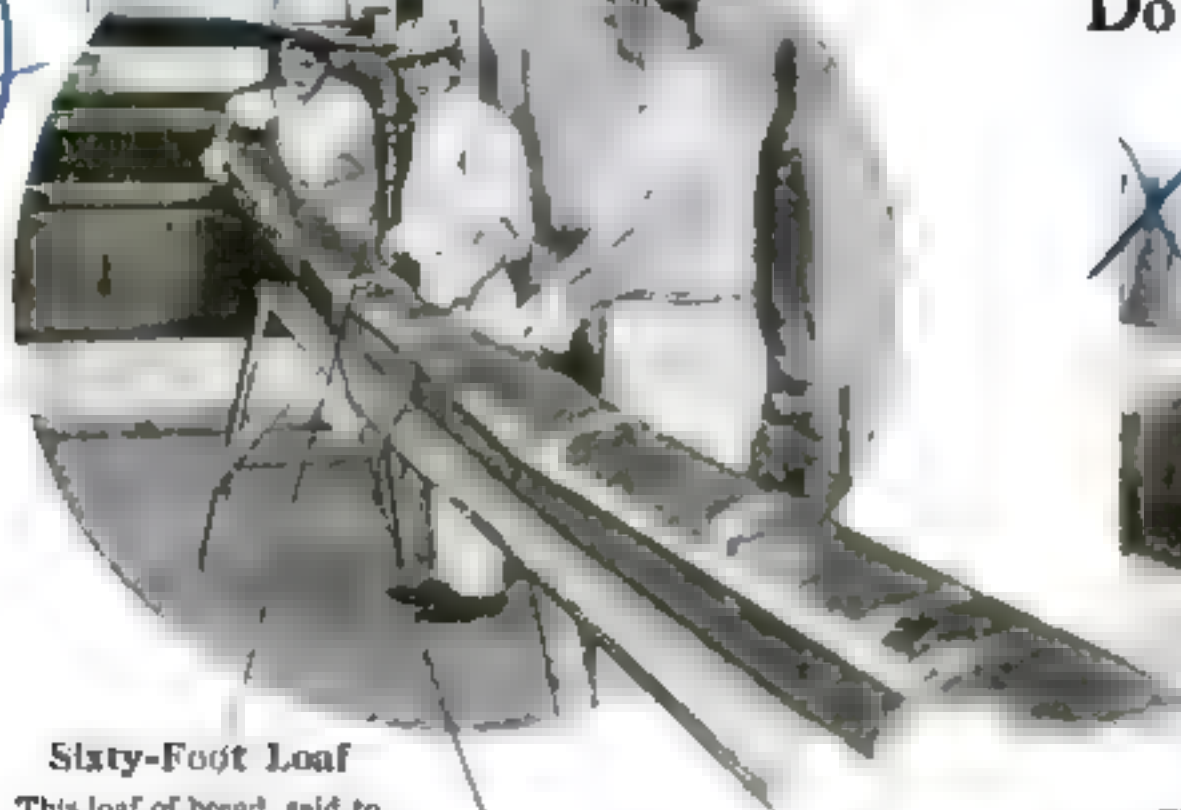


The remarkable one-piece welded boat just before launching at Providence, R. I.



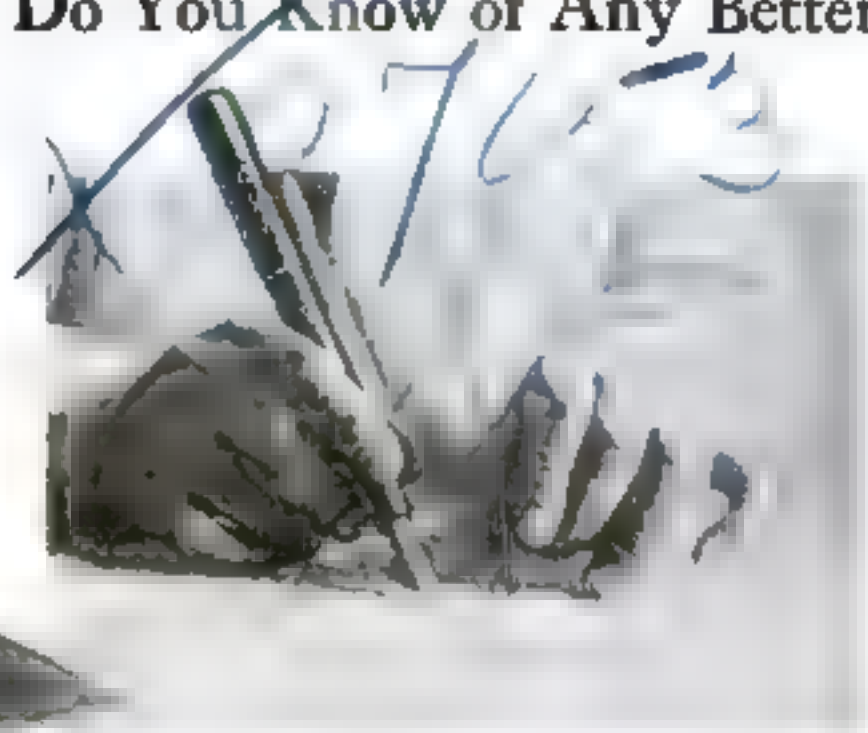
# Interesting Giants

Do You Know of Any Better



## Sixty-Foot Loaf

This loaf of bread, said to be the largest ever baked in one piece, is 60 feet long and contains more than 400 pounds of flour. It was turned out recently in Minneapolis. Bakers here are seen removing the huge loaf from the oven.



## The World's Smallest Fountain Pen

The midget fountain pen will hold a drop of ink and write 300 words, while the large one will hold 120 drops and write 36,000 words. They are shown side by side.

## Huge New Dam

In the Kentucky hills near the town of Burgin, engineers are constructing what is said to be the world's largest rock-filled dam. When completed it is expected to develop 36,000 horsepower, 12,000 more than the great Roosevelt Dam in Arizona.



## Rolling Door Weighs Two Tons

This two-ton rolling steel door, said to be the largest made, was installed recently in a Brooklyn, N. Y., factory at a switching entrance 45 feet wide and 12 feet high. It is operated by an electric motor, which is shown at right.



## Twenty-Foot Rule

The makers of this enormous slide rule say it is the world's largest. It is 20 feet long when extended, and 10 feet long when closed. Compare it with the ordinary foot-rule that is held in the child's right hand.



48320



# and Unusual Midgets

Claims to Records than These?



## Inch-High Electric Motor

The tiniest motor made by H. McBrown of Houston, Tex., is less than an inch high and weighs only a quarter of an ounce.



## The Largest Rock Ever Quarried

From the Stone Mountain Quarry at Atlanta, Ga., was taken recently what is believed to be the largest boulder ever quarried. It is 40 feet high and contains 100,000 cubic feet of granite. Compare it with the man.



## Railway Giant

The hundred and thirty-ton engine up this list is the latest recently built by a Delaware & Hudson Railway engineer. It is said to develop one-third more power on one-third less fuel than any previous locomotive.



## Midget among Airships

The world's smallest aeronaught dirigible, the MR, was completed in Rome a few weeks ago from designs by Leonardo Umberto Nobili. This little airship is only 15 feet long when compared with the giant dirigible, the rigidible Los Angeles. It is intended to develop a speed of about 40 miles an hour.



## A Knife with 75 Blades

Some of the most perfect blades ever made are contained in a marvelously carved knife produced by William Barfirth, member of a cutlery firm in Sheffield, England. The knife contains 75 blades, many of them ornamented with designs that are considered among the most perfect ever worked in steel.

## A Book with 4000 Pages

Containing 4000 pages, this Chamber of Commerce registry book is said to be the bulkiest volume in the world. It weighs 340 pounds.



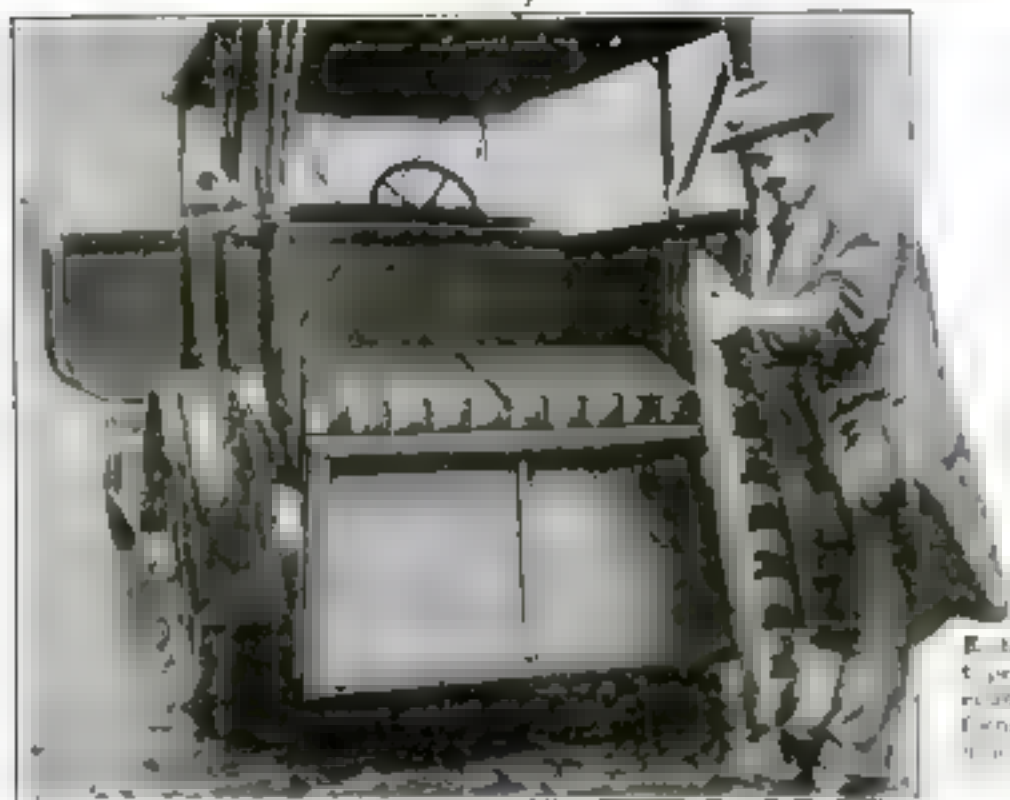
27283



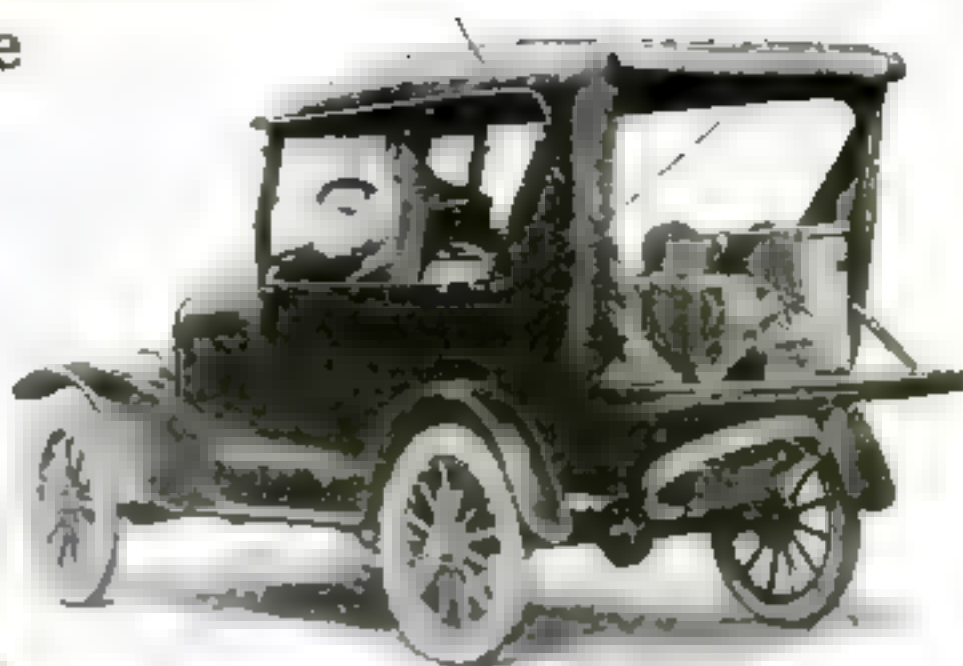




## Cars for Business or Pleasure



Best use of these two types of convertible bodies enables the owner to transform his pleasure car quickly into a small truck

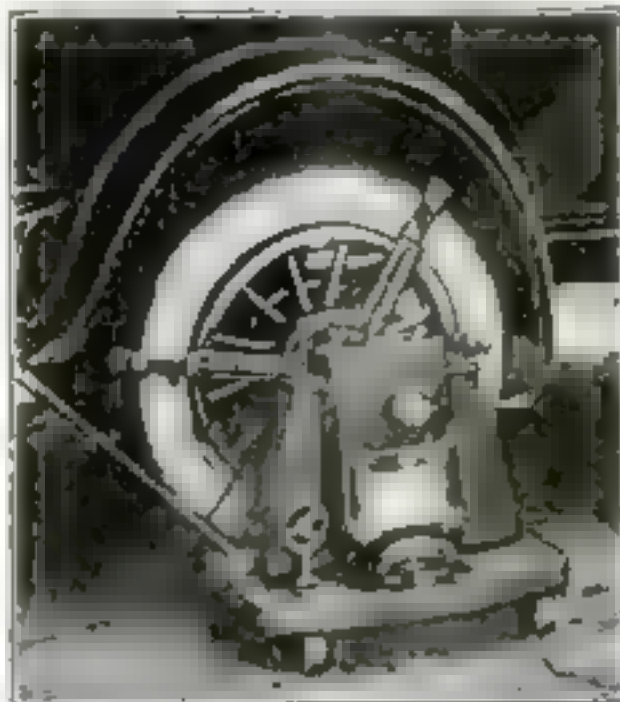


### This Auto Can Be Turned into a Delivery Truck

A QUICK change from a comfortable and roomy pleasure car to a small delivery truck has been made possible by a newly devised automobile body with convertible seats.

When it is to be used for pleasure, the car is provided with upholstered seats. When it is to be converted into a delivery truck, these seats are taken down and reversed to form a smooth cargo floor. The rear of the body is on hinges and swings downward to provide access to the truck from the rear.

THE state of Massachusetts recently began construction of a system to attract the roadways of a small but to what is possible highways for motor-truck transportation routes.



Driven by an electric motor, this testing machine turns the wheel against the brake

### Convertible Body Useful for the Farmer

ANOTHER new type of convertible body for Ford cars is especially designed for farmers and merchants who use their machines for both pleasure and business. This body is designed that the rear seats fold forward into the floor and out of the way. A tailgate can be lowered from the rear.

When the tailgate is closed, there is nothing to distinguish the machine from other pleasure cars of the same make.

The manufacturers claim that it can be converted from pleasure to business car in less than a minute.

### Auto Brakes Now Tested by Machinery

TOO often the adjustment of automobile brakes has been done by approximation and guessing. By means of an ingenious dynamic brake tester recently invented, one can tell exactly how many pounds of pressure there is on a brake drum while the wheel is in motion, and make adjustments accordingly.

Only one man is required to make the test with this machine. After jacking the car off the floor, he sets the brake pedal with a special depressor that holds the foot on the brake under a constant pressure. The brake tester, driven by a motor, is then clamped firmly to the automobile wheel.

An electric motor turns the wheel against resistance of the brake, and an indicator on the machine records the number of pounds pressure at all points on the brake drum. Adjustments can be made while the brake tester is on the wheel.

In case of four-wheel brakes, the front wheels usually are given two-thirds of the pressure applied to the rear wheels.

### Plan Revolving Garage

A POSSIBLE solution of the shortage of parking and garage accommodations is offered in a revolving garage to be erected soon in the West End of London, England.

The floors of the garage will be arranged as concentric rings, each of which will be divided into a number of one-car compartments. The floor will be revolved so that any compartment can be brought into line with the main entrance.

### Flexible Traffic Post Takes Hard Knocks

SCIENCE and man's inventive genius are continually trying to care for the careless motorist. One of the resultant products is a portable flexible "iron man" as a traffic guide for street closing. The invention is designed especially for suburban and rural districts where stationary concrete or metal traffic posts very often are a menace, especially at night-time.

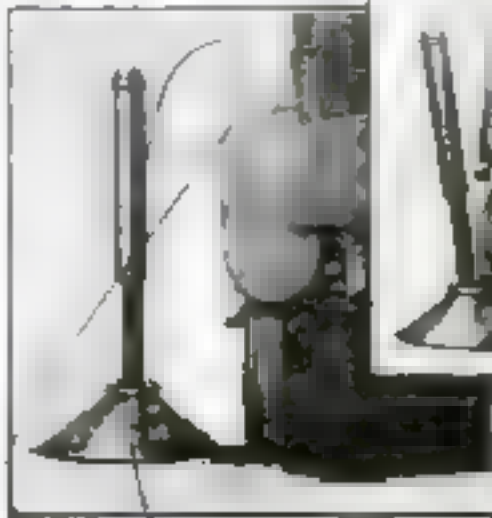
When a car strikes this signal post, no damage is done, for the upright is mounted on a heavy but flexible spring. This allows the signal to bend down out of the way so that the car may pass over it harmlessly. The upper half is made of tube steel and is half an inch larger than the supporting spring.

When a careless motorist rubs or knocks against the signal, the tube striking against

the spring rings so that it may be heard two blocks away. Red lights may be attached to the post. Snow, ice, and inclement weather are said not to affect the operation of the new signal device.



This new portable traffic post is mounted on a flexible spring so that if struck by a car it will bend, as shown above preventing damage to both the car and the post





## Dressing Rooms for Taxi Drivers

**K**EEPING clean and well groomed is a business matter. This is the belief of a Chicago taxicab company that recently installed dressing-rooms for its drivers in several garages. These rooms are equipped with the most modern con-

veniences for bathing, shaving, grooming, and even for polishing shoes.

No one appears more constantly before the public than a taxicab driver, and upon his appearance, the company be-

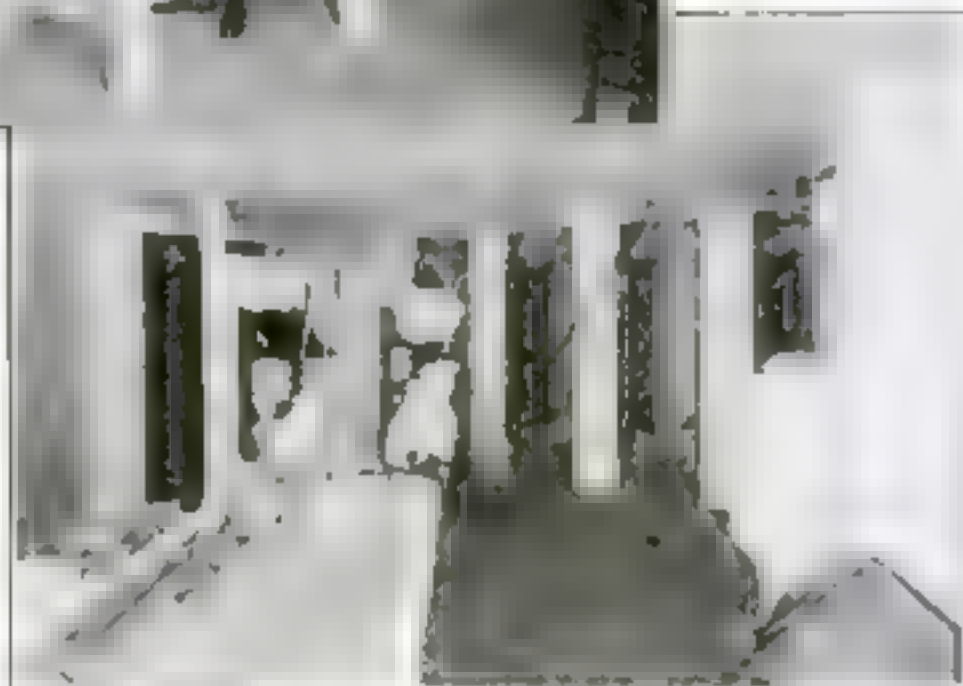
lieves toward his customers. With a good appearance comes a bearing of self respect.

A FRENCH inventor, Dr. Guiche, has perfected a method that enables an airplane pilot to tell by sound his exact flying speed.



### It Pays Them to Look Fit

Every taxi driver is concerned with his appearance. It is all so simple, really, and yet so often neglected. A driver who is clean and well-groomed is sure to attract more business. Here he has a chance to look his best before the public.



## Heavy Moving Simplified by Low-Slung Van

**T**HE heavy job of lifting large packing cases and articles of furniture in load or unloading a motor-van has been simplified by a new type of motor-van with extremely low chassis and body.

The floor of the moving truck is placed above the level of the average sidewalk, thus greatly reducing the lifting distance

for the furniture remover or the expressman.

The low center of gravity also is said to promote greater safety in turning corners with a heavy load, and better riding on rough roads.

The new type, known as the low-slung motor-van, is the invention of a factory truck manufacturer. A striking comparison with the ordinary type of motor-van is shown in the accompanying illustration.

By causing successive waves of sound to interfere with each other's transmission, Dr. G. W. Stewart, a professor of physics at the University of Iowa, has perfected a device that he believes a great deal of time may be used to eliminate undesirable noises and to adjust sounds to suit the taste and the nerves of any individual.



The new low-frame motor-van left compared with an ordinary van.



## Simple Wire Brush Keeps Carpet-Sweepers Clean

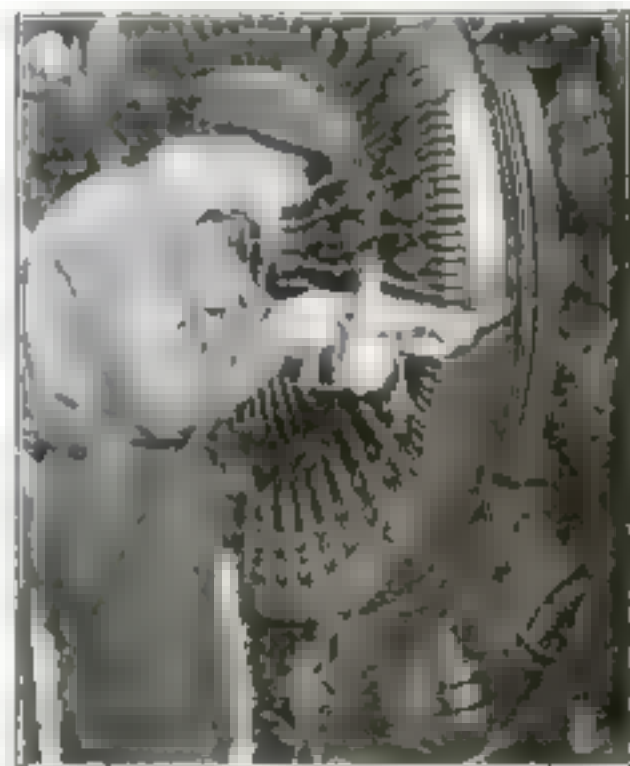
**S**TRONG bent wires in this newly invented brush quickly remove tangled hair and thread from the brushes of carpet-sweepers or from vacuum cleaners. Thus a common annoyance to the housewife has been removed by a simple but effective invention.

## Electrical Blower Cleans Dust from Machinery

**O**PERATING either as a suction cleaner or blower, an ingenious new electrical aid for the mechanic removes coal dust, dirt, and other accumulations from machinery. A hose attachment enables the operator to get at all parts of a large machine or water-tight and eliminate all dust.

The cleaner can be attached to any light truck. In the photograph the device is shown being used as a blower. When used as a suction cleaner, a dust bag is attached. The apparatus can be slung over the shoulder of the operator with a strap, leaving both his hands free for work.

When operated as a blower, the air leaves the nozzle at a velocity of 200 feet a second—nearly 140 miles an hour.

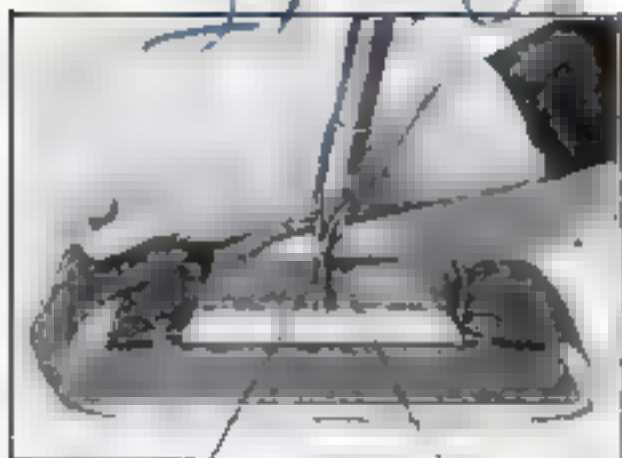


Cleaning machinery with electric blower.

## Sugar Made from Weeds

**L**EVULOSE, a valuable sugar that heretofore has cost from \$30 to \$110 a pound, can now be made cheaply enough for table use by a process perfected by the U. S. Bureau of Standards. It is extracted from tallgrass and from Jerusalem artichoke, a common weed.





## This New Floor-Waxer Has Removable Pads

**BOTH** waxing and polishing pads of a new floor-waxer, which weighs only a few pounds, are removable for washing.

After the wax is spread on the floor with the outside pad, it is unbuttoned and the floor polished with the dry pad underneath.

## New Belt-Lacing Machine Saves Time and Labor

**FOR** mending broken belts quickly, leaving smooth and strong joints, a new part machine has been designed to save the time required by hand work. Belts not over three-eighths inch thick may be laced in a few minutes without removal from the shaft. The tool is designed not only for machine shops and factories in mending heavy belts, but for garages in repairing fan belts. With this tool a garage need keep on hand only a few rolls of belting in popular widths to make up fan belts as required.

No two hook points enter the belt directly opposite each other, so that no belt fibers are broken. The machine embeds the hooks even with the belting surface.



Mending a heavy machine belt.

## Detects Artificial Pearls

**A** SIMPLE new method of distinguishing the Japanese artificial pearl from natural pearls has been discovered by Prof. Daniel Berthelot, a French scientist. He plunges the pearl into colored brilliantly illuminated with converging lights and examines it through a submersible lens.

# Canoe-Sailboat Is Collapsible

**A** NEW design of collapsible canoe that can be converted into a sailboat, is of particular interest to hunters and fishermen. Because of its extreme lightness it can be used on all rivers and streams. It is claimed, even in the

The thrilling sport of shooting rapids loses much of its danger with this canoe.

Over a simple frame of pliable staves, readily assembled, is stretched a specially designed cover in one piece. This is waterproof consisting of canvas with an intermediate layer of rubber. Another

protects the cockpit from rain and splashes of water.

Rigging can be added to the canoe without damage to the structure. The canoe will carry three persons comfortably, it is said, while allowing plenty of room in which to stow away luggage. The frame can be packed in one or two bags.



## A Craft for Sportsmen

Although as small as a canoe, it is a new type of boat, and is said to be a very useful one for sportsmen. It is a small, narrow boat, and is said to be a very useful one for sportsmen.

## Hand Levers Drive Odd Oarless Lifeboat

**ROWING** a boat without oars is the surprising achievement made possible by a British inventor, who recently designed an unusual new type of lifeboat propelled by hand levers. The purpose of the invention was the creation of a craft that could be sent away from the side of a disabled ship without the delay of adjusting oars to their locks.

In place of oars, levers are provided in front of each seat in the boat. There are eight levers in all—four on each side of the craft. They are geared to a propeller shaft so that as the oarsmen pull them back and forth they drive a screw at the stern, sending the boat through the water.

Since, contrary to the old way of rowing, no especial skill is required to operate the levers, the boat requires

only one trained seaman to handle the tiller.

The invention was demonstrated recently at the King George Dock, London.

BECAUSE of temperature expansion and contraction, the Washington Monument is about a foot higher in summer than in winter.



Demonstrating the new lever-propelled lifeboat at King George Dock, London. Geared to the propeller shaft, the levers drive the screw.

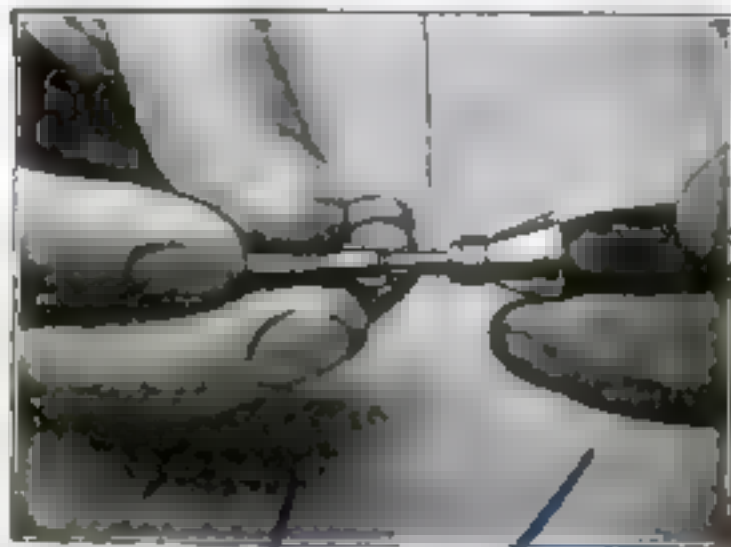


# Ingenious New Devices

## Fourteen Handy Products from

### Self-Soaping Brush

A TWO months' supply of shaving cream is contained in the handle of a new type of shaving brush (below) designed especially for the traveling man. Pressing the handle forces just enough cream for a shave into the bristles of the brush.



### A Pocket Cigar Piercer

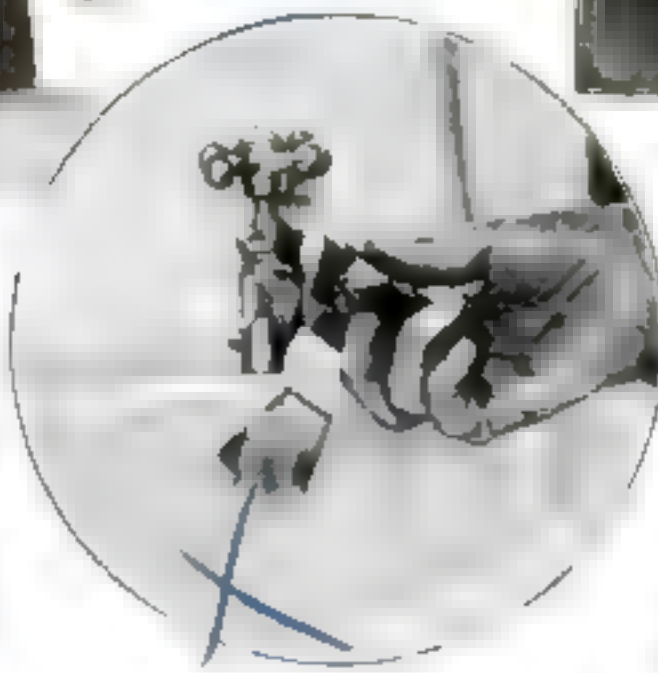
OCCASIONALLY the smoker applies too much pressure to a cigar, requiring considerable coaxing with a pin or other sharp instrument before it will draw satisfactorily. It is because even the best cigars are not always perfect in this respect that the pocket cigar piercer pictured above has been invented recently.

The device consists of a thimble-shaped metal socket into which the end of the cigar is held. Entering the socket is a small drill that is twisted with the fingers.

### Stencil Makes Bow Lips

PERFECT Cupid's-bow lips can be made in a few seconds, even by persons who are inexpert at make-up, it is claimed, with the aid of a newly devised beauty stencil.

The flexible stencil is held firmly over the mouth so that the opening fits the outline of the lips. Rouge or a lipstick then is applied, producing the Cupid's-bow effect.



### Floor Slabs of Concrete

A SAVING of 30 per cent in building costs is said to be made possible by a new method of reinforced concrete construction. In this process small factory-made slabs of reinforced concrete are used instead of the present method of pouring concrete in large slabs. Floors, walls, and partitions made of the small units, the inventor claims, will stand strong that reinforced concrete in one piece will not, and air spaces are provided in which wires and pipes may be laid. These further serve to make walls or partitions soundproof.

A. G. Tabatchnik, a Russian architect, is the inventor of this method, which is said to eliminate the cost of wooden forms and the laying and tying of reinforcement.



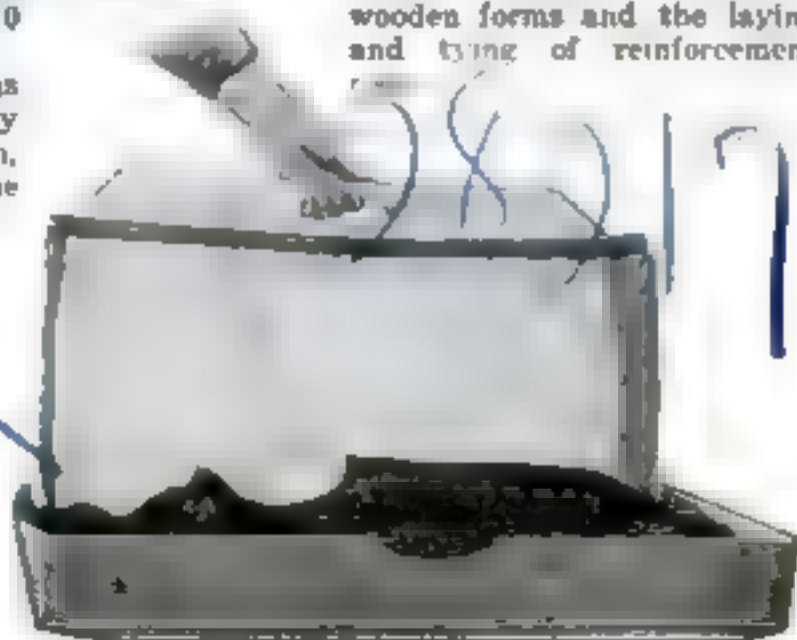
### Wooden Fins for Swimmers

BATHING shoes fitted with hinged wooden fins are the latest aids for the swimmer devised by a Dutch inventor. He claims that the shoes will increase the speed of a swimmer at least 10 times.

When pulled forward, the fins close, and when forced out by the stroke of the feet, they open, pushing powerfully against the water.

### Handy Suit Box

A NEW type of paste-board suit box is made in one piece, with a handle for the lid cut in the board. The box opens like a suitcase and requires no twine to hold it together. Each end of the box is reinforced by a double piece.



### All-Sport Hand Racket

FOR any of the many kinds of ball games that boys and girls play in the street or against brick walls, this hand racket recently has been perfected. The frame and strings are made of gut, with a thin wood backing. The hand fits into an adjustable back strap.



# for Pleasure and Comfort

## the Workshops of Inventors



### Reflector Serves as Stove

A POINT in the stem of this ingenious reflector permits it to be turned into a simple burner upon which one may cook the morning coffee. When upright the device serves as an ordinary heater.

### Ferns Water Themselves

FERNS water themselves provided with the apparatus recently patented. The soil absorbs water from a porous porcelain cone that draws water from a reservoir bottle fitted with a siphon.

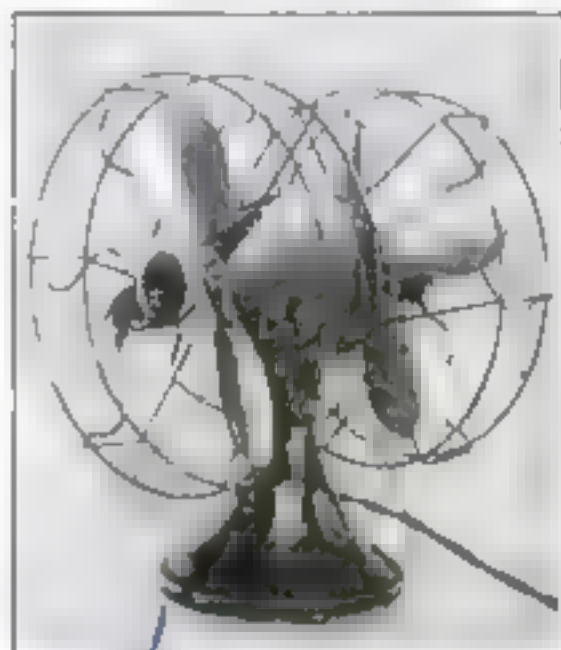


### Adjustable Safety Razor

THE latest type of safety razor may be adjusted to any desired angle. The shaver may use it in the regular safety style with the blade at right angles to the handle, or at another angle, giving a diagonal stroke.

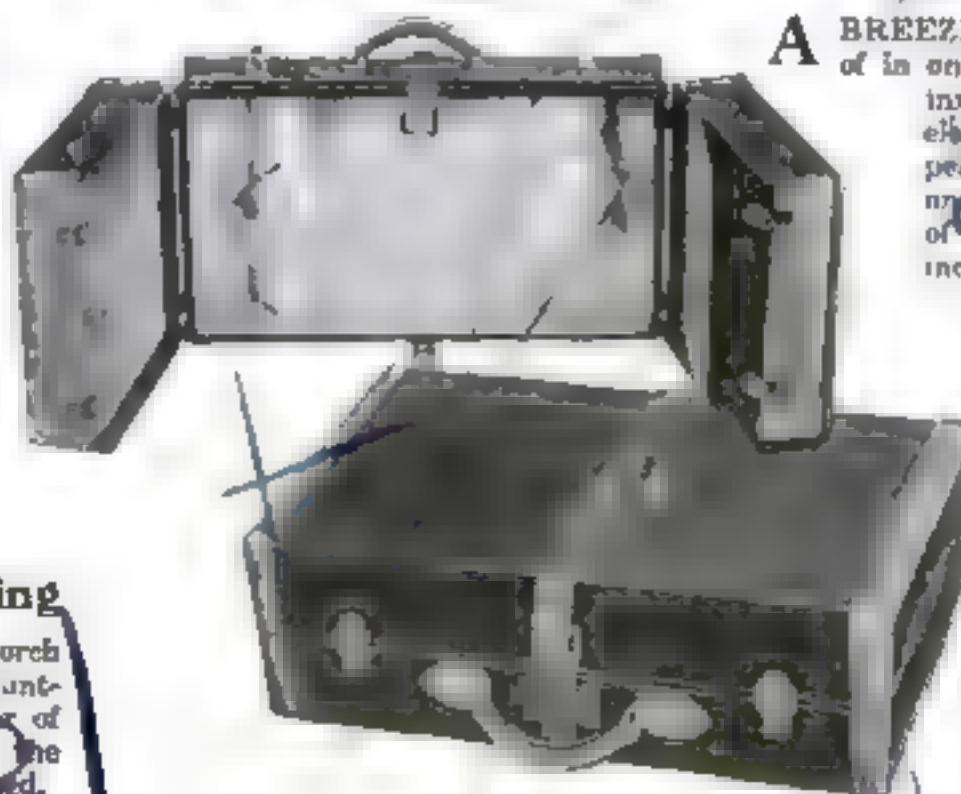
### New Full-Length Mirror

THIS portable floor mirror invented by a Frenchman, shows the hem of a skirt, the grace of a neck line, or the entire gown, thus serving the purpose of a full-length mirror. It is easily adjusted to position.



### Two-in-One Fans

A BREEZE in all directions instead of in only one was the aim of the inventor of this two-in-one electric fan. It has two propellers on the same spindle, one on each side. The quantity of air distributed is said to be increased.



### New Suitcase

POPULARITY of the wardrobe trunk led to the manufacture of a new suitcase that has a compartment for hats as well as for shoes and soiled clothing. In one half is ample space for suits and dresses, while the other half is divided into the two sections.

### A Squeakless Porch Swing

TO ELIMINATE squeaks in porch swings, Joseph E. Morse, of Huntington, Ind., has invented a hanger of ball-and-socket joints suspending the hooks to which the chains are attached.





## Home Chlorine Treatment for Colds



How the new chlorine inhaler is used for the treatment of colds at home. A special chlorine compound is used.

FOR treating colds at home with chlorine gas, a gas-generating inhaler recently has been devised. This is used with a special compound containing chlorine, which is given off when the substance is heated.

The strength of the gas is said to be easily regulated by the patient and a single treatment to cost about a cent and a half.

## Perfect Noiseless Plane

BRITISH aviation experts are reported to have virtually eliminated the deafening roar of airplanes in flight. By a new device, it is said that exhaust gases are permitted to escape noiselessly without loss of speed. A new engine has been devised by an ingenious arrangement of gears.



## Swedish City Has Fresh-Air Telephone Booths

EVERY one who has been cramped in poorly ventilated drug-store telephone booths, can appreciate the cleverness of the Swedish inventor who thought of putting public telephones in boxes out of doors, on convenient street corners.

The booth illustrated above is of the latest design, erected recently by municipal authorities in a large city in Sweden. Open lattice-work admits fresh air.



## Cradle Lays Pipe Line across Straits

TO SAVE time in laying a pipe line from Hetch-Hetchy, the water supply source for San Francisco, across the Dumbarton Straits of San Francisco Bay, engineers recently devised and employed the huge tiding cradle pictured above. So quickly and accurately does this mechanism place the pipe in position, that the engineers planned to complete the job in 60 days.

The photograph shows one section of the pipe being lowered.



George Taylor of the U. S. Department of Agriculture doing his research.

## World's Finest Wire Is Too Small for Eyes to See

THE finest wire ever made, wire so slender that it cannot be seen with the naked eye, was manufactured recently by George Taylor, a physiologist in the United States Department of Agriculture. In the photograph at the left he is seen at work in his laboratory.

Work of this kind is not only a novelty, but a practical commodity. Among those who use extremely fine wire are surgeons and dentists.

AN EXTREMELY FINE WIRE, reflecting light, has been made in one month with a glass rod and a diamond.

## Machine Predicts Tire Life

HOW long will your new tire last? It is to the manufacturer's interest to know the answer to that question before the tire leaves the factory. A machine for testing the durability of automobile tires, making accurate predictions of the service they will give, has been devised recently by experts of the U. S. Bureau of Standards at Washington, D. C.

A tire is run under standard conditions against the rim of a wheel provided with bumps. After a certain time the tire is examined for signs of failure. Weak points in the tires show up in a very short time, often in as little as two days. In actual service such a tire might last from six months to a year.

Tests are made also to determine whether the chemical and physical properties of the materials are those required by the specifications and found to be necessary for the construction of durable tires.



Measuring the durability of an auto tire with the testing machine.



## Unique Lifebuoy Rides Heavy Seas

IN AN ingenious new life-saving buoy, recently tested successfully in the North Sea, the victim of a shipwreck can survive in safety and in comparative comfort as long as his provisions last, the inventor claims.

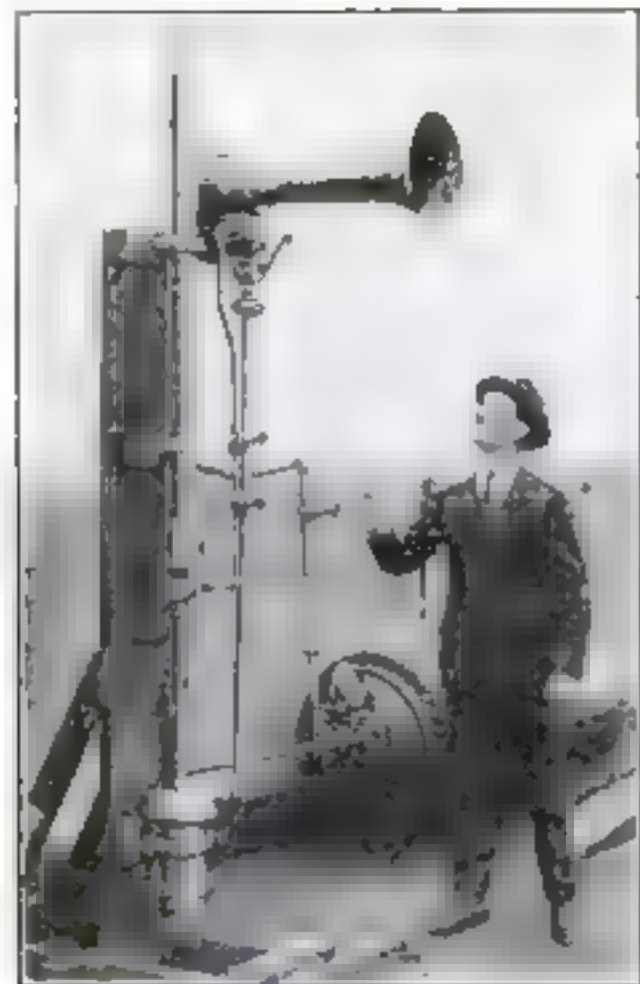
The buoy with its passenger rides easily over the waves, even in severe storm, it is said. A porthole in the upper part of the device can be opened and closed. It is just large enough for the occupant to thrust his arm through and fire a pistol to attract attention, as shown in the photograph.

THE next eruption of the volcano Etna may be heard by radio throughout Europe and possibly in America. Signor Marconi is establishing a new radio station on the rim of its crater and purposes to broadcast its mutterings.



The occupant of the lifebuoy is able to thrust his arm through the porthole to fire a distress signal if help is near.

Below is a new type of mill designed to catch more power from the wind.



## Motor-Ship Whistle Made to "Smoke" without Steam

THE advent of the motor-ship, using diesel oil-burning engines instead of steam, presented a real problem in the matter of adequate whistles. For the usual puff of steam that told the pilots of other ships where the whistle came from was lacking. Compressed air employed to operate the whistle produced plenty of noise, but no visible signal.

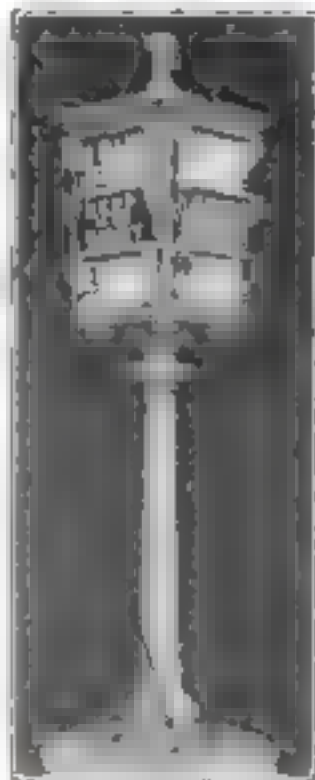
The problem was solved recently when a motor-ship engineer conceived the idea of using a tank of liquid smoke, like that used in airplane sky-writing, in conjunction with the compressed air. This smoke pours forth every time the whistle is blown.

The ingenious new invention is pictured above.

## Illuminated Sign-Posts to Aid Tourists

ILLUMINATED sign-posts to direct motorists on unfamiliar roads at night as well as in the daytime were exhibited recently at a national convention of American road-builders in Chicago. The signs can be read in the sunlight as clearly as when illuminated at night.

They will be placed at many important junctions on public highways, where they will aid tourists by giving directions.



How the signs appear at night.



## Dry-Land Houseboat, "Sails" on Artificial Lake

WHILE he lived on a hilltop, H. A. Heroux, of Oakland, Calif., longed for sea life. So he built a house in the shape of a boat, surrounded it with an artificial lake, and now enjoys cool breezes from the deck of his unique home.

In the heaviest of storms the occupants have no fear of seasickness since the house is stationary, having a concrete foundation.

It cost the skipper-owner, who is shown in the photograph above, \$20,000 to construct his odd boat-house.

## Turns Wind Power into Electric Current

IN THE design of a revolutionary new type of windmill called the "aerodynamo," which converts wind power direct into electric current, Major Blau, a German inventor, believes he has discovered a valuable source of economical power.

It is claimed that the aerodynamo can utilize 50 per cent of the wind's energy. It differs from previous windmills in the fact that the wind wheel is placed to the lee of the tower or mast supporting it. A

vane of special design, placed to the windward, sweeps the wind directly to the back of the wings, where it can exert the most power. In previous types of mills the wind stream has been broken up behind the wheel, where the vane has been located. Thus much of the wind's energy was lost.

The photograph shows the arrangement of wheel and vane; also the small vanes that are attached to the wings and that add to their power.



## Pocket Light Projects Pictures

ONE of the latest novelties in entertainment is a small picture projector that can be carried in the pocket. The light necessary for projection is provided by an electric flashlight, and pictures can be thrown on any white surface. When in use, a telescoping lens is extended from the case. Tiny slides are inserted in the usual way. Although the entire outfit is hardly larger than a pocket flashlight, the pictures are said to be reproduced sharply and clearly.

In the photograph, the picture of a lioness is projected on a smooth wall.



Projecting the picture of a lioness on a white wall

AN AVERAGE of 30 per cent of the available power of gas line for motors is being wasted by its discharge in the engine exhaust in the form of combustible gases, according to recent government tests.

### Sanitary Kit for Baby's Bottles and Wardrobe

A BABY kit for carrying the baby's clothing and milk when away from home has been introduced recently to take the place of makeshift bags, commonly used for that purpose. The kit is lined with washable blue or pink rubber and in the bottom of the case are aluminum bottle holders.

Clean clothes may be packed in a pocket in the lining, while soiled clothing is carried in a rubber pocket entirely outside the bag proper, a notable sanitary feature. This compartment is removable. The bag is waterproof and the exterior as well as interior can be washed with soap and water.

### Know Your Car

ONE of the best ways to start the motoring season right is to give your car a thorough cleaning. This should include the top and upholstery, too often neglected.

Sweep off the top first. If the top is leather, a mixture made of half a cup of turpentine, half a pint of raw linseed oil and four cups of water is a good cleanser. Apply with a clean rag and rub dry.

For mohair tops make a lather of a pail of tepid water and a bar of Castile soap. Use a large, clean sponge and wash the top well. Go over it with clear water to prevent streaking.

Plain water with a little ammonia will remove dirt from leather upholstery, after which the cushions should be rubbed with a clean woolen or flannel cloth. Do not use gasoline on leather.

Cloth upholstery may be cleaned by rubbing it with a sponge dipped in the following mixture: Three-quarter ounce common salt, two ounces grain or wood alcohol, mixed with clear water. Lukewarm ivory soapuds will remove grease or oil spots.

Clean all glass windows and reflectors with a mixture of half alcohol and half water.

### Fun for One on Spring Seesaw

FOR the child without a playmate an ingenious new mechanical seesaw operated with a spring, will provide hours of entertainment. No one is needed at the other end. The spring takes the descent of the child, and helps to pull him up again after his feet touch the ground.

The meter is operated by the child's pushing the ground with his feet, or it can be swung with a body motion. It is equipped with a comfortable saddle and with handles to prevent the possibility of the small child's falling off. It can be moved easily from place to place.



A spring balances the lone rider on this ingenious new device

### Wires Made Fireproof

FIREPROOF insulation for telephone switchboard wires is made possible by a newly discovered use for selenium, an element hitherto used chiefly in the control of electric current by light. The flameproofing of switchboard wires is highly important, for even a small fire can throw a whole exchange out of commission.

### Phone Numbers Magnified by Glass Attachment

A MAGNIFYING GLASS that can be attached to any telephone aids in reading small type numbers in the telephone book. It folds out of the way when not in use.

### Wet Coal Is Costly

RECENT tests by the U. S. Bureau of Mines show that the wetting of coal is expensive to the consumer. Fine sizes of both bituminous and anthracite will hold up to 20 per cent in moisture, though larger sizes of the bituminous increase but little in weight when dampened.

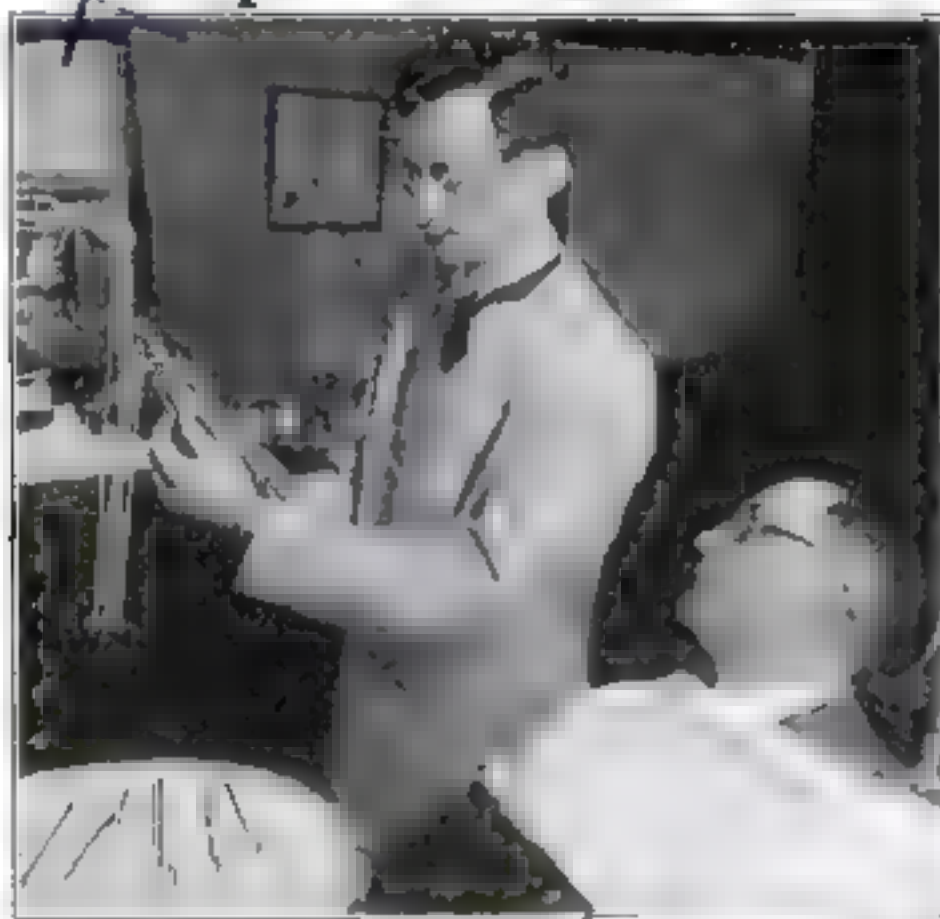
Coal can have a perfectly dry appearance, yet still contain as much as 10 per cent moisture, for which the consumer pays. A moisture content of 12 per cent is not at all uncommon.



How the magnifying glass is attached



## Compact Sterilizer Aids Dentists



The new sterilizer held by the inventor, Dr. P. L. Nemmers

A DEVICE that keeps drills and other attachments used in dental work continuously sterilized is the invention of Dr. P. L. Nemmers of Chicago, Ill. For its compactness and the ease with which it is used it was commended by dentists at a recent national dental convention.

RECENT tests show that silk braid used in stringing pearls and other jewelry may be destroyed by the luster of pearls may be destroyed.

## Portable Electric Heater Useful as a Lamp

BECAUSE of the unusual shape of its reflector, a compact new brass electric heater is said to focus intense heat in a given direction instead of diffusing it as does the usual bowl-shaped type of heater. For quickly heating small rooms, such as a bathroom or nursery, this feature is said to be advantageous, when time is important.

Its heating element is of a screw-down type that is easily renewable. An electric-light bulb can be substituted for illumination, if desired, the reflector producing a powerful beam of light.

The heater rests on heavy glass supports. It is equipped also with an adjustable metal bracket with screw holes, by which it may be attached to the wall in any desirable place. It is provided also with a 15-foot extension cord. It can be used on either direct or alternating current.



New electric heater with wall brackets



## Chicago Churches Install Offering Safes

DURING a crime wave in Chicago recently the collection boxes in so many churches were stolen that specially designed burglar-proof offering safes were installed in 10 churches.

Three slots in the top of the safe are provided to receive a many kinds of offerings, which drop through chutes into compartments reserved for them. Sharp teeth at the end of each chute prevent the possibility of a thief's stealing the coins by lowering a sticky substance on a string from outside. The safe is of extremely heavy construction to prevent any attempt to remove it bodily.



## Concrete Surfacing Tool Driven by Motor

FINISHING the surface of concrete after the rough work is done and removing irregularities and preparing the surface for painting are some processes that long have been expensive. A simple new portable surfacing machine driven by electricity recently has been perfected to do the work in much less time. Its fine cutting action is said to produce a much better surface.

The machine can be used also to produce special finishes on imitation stone, to cut brick walls preparatory to applying stucco, and to grind paint from bricks. In use, the motor hangs at the side of the worker, and is slung from a strap over his shoulder, leaving both hands free to operate the light power tool.

## How Much Science Do You Know?

HERE are a dozen simple questions such as might be put to you any day. How many of them can you answer intelligently?

Answer each one to the best of your ability, then turn to page 144 and see how nearly you were right.

Twelve more questions will appear in next month's issue.

1. How much water is there in an inch of rain?
2. Why can deaf persons sometimes hear through their teeth?
3. What are phonograph records made of?
4. Why do bubbles collect inside of a glass of water standing in a warm room?
5. What do fishes eat?
6. Why is the moon sometimes seen in the daytime?
7. Why do moth balls get smaller and finally disappear when put away with clothes?
8. Can elevator motors interfere with radio reception?
9. Will the earth ever stop spinning?
10. Why does being near a dynamo sometimes spoil your watch?
11. What is a candlepower?
12. Why do people yawn?



# Science Eases the Labor

## New Fixtures for Kitchen and Bedroom

The flexible metal nozzle of the oilcan at the left makes it invaluable for reaching awkward corners in the carpet-sweeper's or the vacuum cleaner's out-of-the-way joints

An egg-beater that fits an ordinary drinking-glass has a combination motion. A whirling propeller throws the egg into the center of the glass, where it is caught by a dasher and plunged up and down until beaten enough

Slicing eggs or beets can be accomplished neatly and quickly by this device which is made of a grid of fine wire that is pressed through the food

A rubber hose with small projections keeps this new sugar dispenser from sliding over tables that have polished wood or glass tops. The hose is removable for washing

Double shoe trees keep shoes together in a hanger. Pressure is exerted from each toe to the opposing shoe on the heel. A small hook in the center hangs the trees on the rack

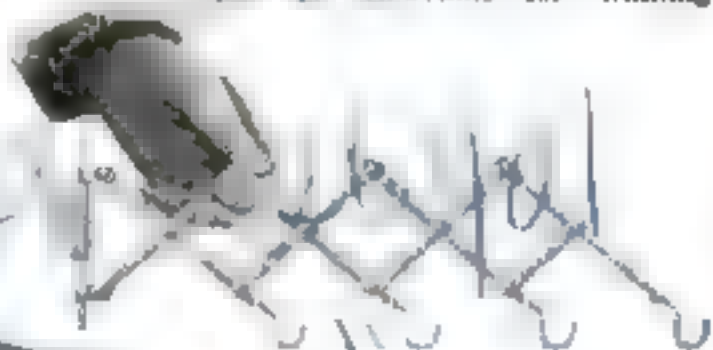
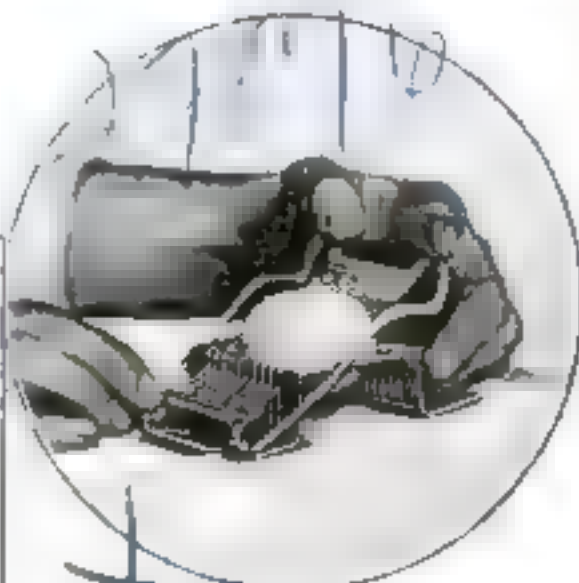
It is the handy one that every man should have nowadays. The one above is particularly useful because it will swing three ways and collapse or expand as the occasion demands

This collapsible clothes hanger is useful for hanging dresses and coats. The frame adjusts to several sizes and allows easy packing. The top hook fits in

A comb will prevent colds after One part of the comb is heated, and held into the comb proper, which of aluminum readily conducts the heat

Keeping a comb clean is an easy matter with the device shown above. It is held like a razor strap, hooked at one end to an adequate support

An automatic stand for the electric iron prevents overheating of the iron, as the current runs only while the iron is in use or off the stand

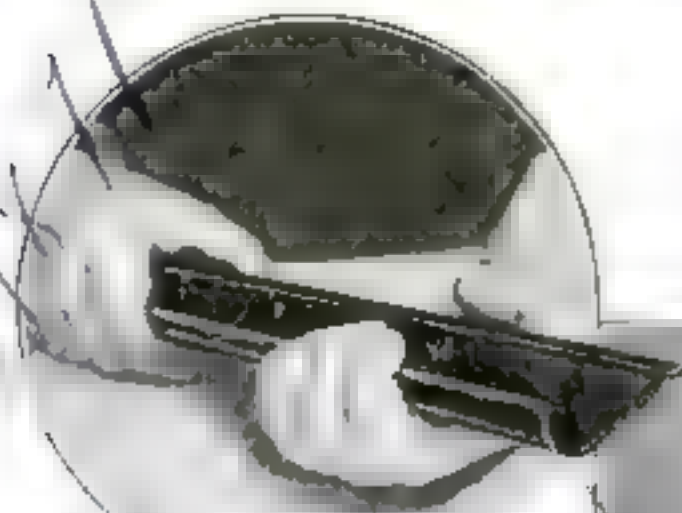




# 'of the Modern Housewife

## Simplify Many a Home-Making Problem

Fish-scaling will be found a less disagreeable task with this new scaler. The handle is cleverly designed so that the hand grasps it easily, and the many teeth finish the unpleasant job quickly.



To prevent drafts, a light, strong strip of bent metal is designed to be slipped under the door and fastened by two screws. Tightening the screws adjusts the strip to its frame.



A stool in the kitchen needs rest for the housewife. This white cylindrical rest that swings in under the sink will save her aching back by also saving floor space and added efficiency.

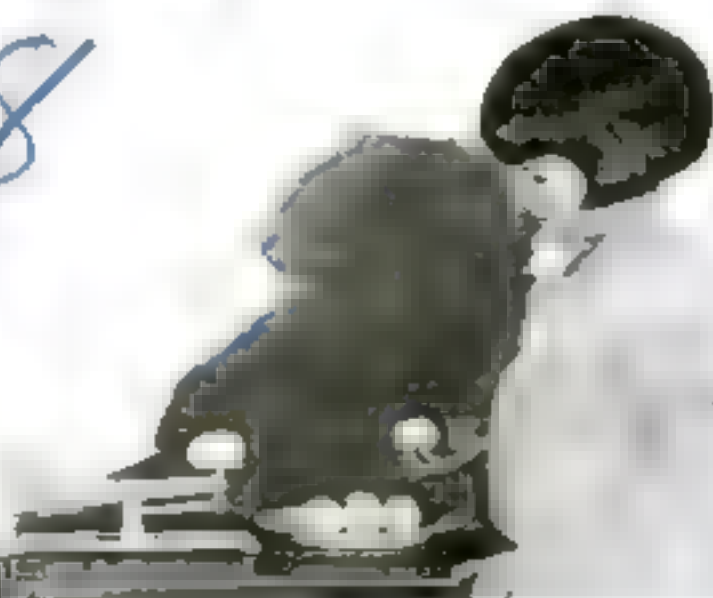
Mayonnaise can now be made under a faucet. When the water is turned on, the beater revolves, while oil drips slowly from a container above the bowl.



A cone-shaped aluminum egg separator that fits on top of an ordinary tumbler, prevents broken yolks. The white runs slowly through a slotted section, leaving the yolk in the top of the metal separator.



This new dish-dryer has graduated bins that keep delicate and heavy china separated, preventing much unsightly chipping.



Even children can grade eggs with this new invention. When an egg is put in the grader, the beater automatically adjusts itself. The lowest number indicates the weight of one dozen eggs of the same content.



This built-in garbage receiver is convenient and sanitary. When the door is opened, the can swings out with it, and the built-in door keeps in unpleasant garbage odors.



This safety can opener keeps the can at a distance. Turning the key clockwise makes the can revolve, and a sharp-edged steel wheel neatly cuts off the top.

For condensed-milk or syrup containers this can-opener and spout is useful. A sharp point is pressed into the lid and given half a turn to fit it snugly into the hole.





# How to Build a Radio-Frequency Amplifier

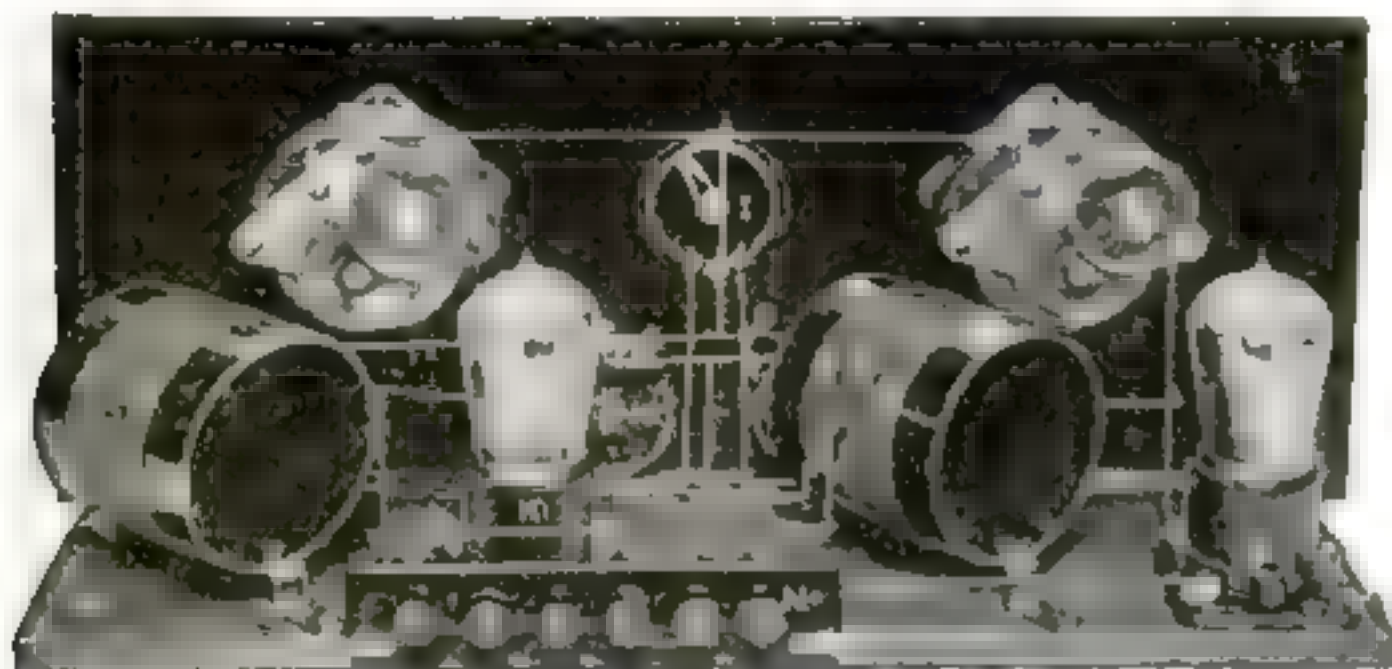


Fig. 1—Rear view of two-stage radio-frequency amplifier showing layout of parts and wiring. The parts are lettered and numbered to correspond with wiring diagram below. Note brass brackets supporting the tuning units. These were made by bending the ends of right-angle brackets.

**I**F YOU already have built a regenerative receiver, the chances are that you are wondering how you can add radio-frequency amplification without having to rebuild your whole outfit.

This article will show you how to do it. And there is nothing tricky about the circuit either—anybody who can get a regenerative receiver working properly will have no trouble at all in adding two stages of radio-frequency amplification to his set.

Do not build this radio-frequency amplifier with the idea that it will increase the strength of the signals from powerful local stations, for if you already use a good outdoor antenna, there will be no appreciable increase in the volume, that is not its mission.

Radio-frequency amplification will be a big help, however, in bringing in distant stations, and what is still more important to many radio fans—it will greatly increase the selectivity so that you will be able to get the distant stations right through the locals when conditions are at all favorable. If you follow the instructions carefully you should have a set that will give the greatest satisfaction.

**FIGURE 1** shows a wiring diagram of the radio-frequency amplifier, and you will note at the right a coil marked *X*. This is the coil used to couple the radio-frequency amplifier to the receiver you now have. Detailed instructions on how to use this coil will be given further on.

Hooked to an ordinary regenerative set, this amplifier unit enabled the writer—in New York City—to bring in WTAS at Elgin, Ill., and several other distant stations with plenty of volume early in the evening when all the locals were on the

## The Parts You Need:

- A* and *B*—First tuning unit
- C* and *D*—Second tuning unit
- E* and *F*—Variable condensers, .0005 mfd. maximum capacity
- G* and *H*—Rheostats
- I*—100-ohm potentiometer
- J* and *K*—Vacuum tube sockets
- L*—Panel 7 by 18 inches
- M*—Wooden baseboard, 6 by 17 inches
- N*—Binding-post strip, 1½ by 6 inches

Two pieces of composition tubing, 3 inches in diameter by 3 inches long two dials (if they are not included with the variable condensers) six binding posts, brass right-angle brackets, bus wire, and wood screws.

air. The same stations could not be tuned in on the regenerative receiver alone without considerable interference from the local stations.

The radio-frequency-amplifier unit adds two tuning controls, to be sure, but since it eliminates the need for a tickler in the regenerative set and also dispenses

**T**HIS simply designed unit of one or two stages can be added to your present set without rebuilding. It will bring in the distant stations more clearly.

By Alfred P. Lane

with antenna tuning where this is used, the total number of tuning controls remains at three—the two dials of the radio unit and the dial of the secondary condenser or grid variometer in your present set.

It is quite possible that the radio-frequency amplifier as illustrated does not match the design of your present receiver either in size or in the arrangement of the binding posts.

**T**HE panel *L* was made 7 by 18 inches because so many radio constructors favor this size and the binding posts are mounted at the back on strip *N*, since this is the style at present. If your receiver is built with the binding posts on the panel, you can follow the same style in the radio-frequency-amplifier unit by placing binding posts Nos. 1 and 2 at the left end of the panel, as seen from the front, with binding post No. 6 at the right end opposite the antenna binding post of your present set. Leave the remaining four binding posts, which are for the battery connections, where they are shown in Fig. 1.

The radio-frequency-amplifier unit will give best results with ¼-ampere storage-battery tubes and 90 volts of B battery; but dry-battery tubes can be used with satisfactory results, although it may be necessary to add three or four turns to coils *C* and *X* when the smaller tubes are used.

You will note that there is no binding post for the minus-B-battery connection. This has been left out purposely. Ordinarily the minus-B-battery binding post is connected with the plus-A-battery binding post, but since this connection with the filament circuit has been made already in your present set, it is useless to do it again. Besides, if by chance the minus-B-battery lead in your set is connected with the minus-A-battery wire instead of with the plus, an additional connection in the radio-

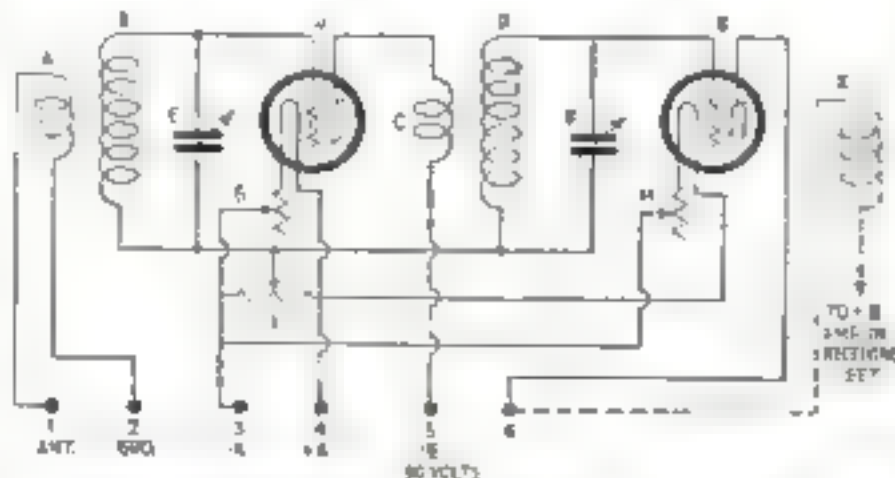


Fig. 2—Wiring diagram. The coil *X* is built into your receiver as shown in subsequent diagrams (Figs. 7 & 8, and 9).



frequency-amplifier unit might short circuit your storage A battery with rather disastrous results to the wiring, to say nothing of the effect on the battery itself.

**T**HE tickler coil, or plate variometer, should be cut out of the plate circuit of the detector tube in your set when used with this radio-frequency-amplifier unit because you can get the set up to the point of oscillation on any wave length by adjusting the potentiometer *I*.

There are many other ways to control oscillations in radio-frequency amplifying circuits besides the potentiometer, and some of them could be used very well in place of this instrument in the amplifier as constructed. However, the potentiometer arrangement is foolproof, and a slight adjustment of it will compensate for variations in different tubes, coupling between stages, and so forth.

The use of a separate rheostat for each tube is worth while, since often two tubes have slightly different characteristics. One tube may require a bit more current than the other for best results.

Those fans who desire to build a one-stage radio-frequency-amplifier unit instead of a two-stage can do so very easily. Just eliminate parts C and D, F, H, and K, and connect the plate terminal of socket J with binding post No. 5 instead of with coil C.

**T**HE parts you will need are listed on page 74.

The sockets J and K and the rheostats G and H should, of course, be chosen to suit the tubes you use. A 200-ohm potentiometer will do just as well as the 400-ohm one specified, although the higher the resistance of the potentiometer, the less current it will drain from the A battery.

After you have bought all the parts, lay out the panel according to the diagram in Fig. 4. Note that only the location of the holes for the shafts of the instruments



Fig. 3—Panel layout. The knob controlling the potentiometer *I* is shown between the two condenser dials. It controls oscillation. Place the binding posts on panel if you so desire.

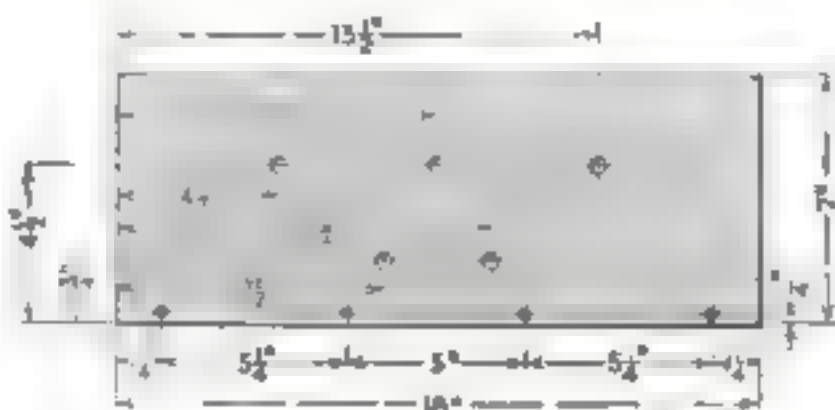


Fig. 4—Diagram for drilling the panel, with exact measurements indicated. Only the holes for shafts are given. Lay out holes for supporting screws from templates supplied with the instruments.

is given, since so many instruments are single-hole mounting, and the ones that require holes for mounting usually are supplied with templates. The easiest way to drill the panel without scratching it is to mark off the locations of the holes on a piece of paper the exact size of the panel. Then paste the paper on the panel with library paste and drill the holes right through the paper after you have made a good center punch mark for the center of each hole. After the holes are drilled the protecting paper can be washed off.

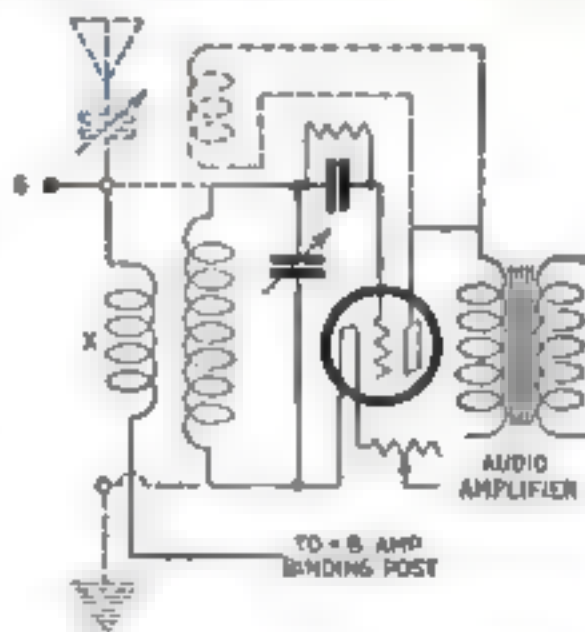


Fig. 7—This wiring diagram shows how to connect the radio-frequency amplifier unit with a single-circuit set. Coil X should consist of four turns of bell wire wound around the secondary coil. All parts and wires shown in dotted lines should be eliminated.

The panel is fastened to the baseboard by means of four round-headed wood screws. The locations of these screw holes are included in the panel layout in Fig. 4. Mount the instruments on the panel as shown in Figs. 1, 5, and 6. It is well to set the condensers E and F with the plates up instead of down to allow more room for the coils.

The winding of the coils is the next step. They are wound on composition tubing 3 inches long by 3 inches in diameter and mounted on the baseboard by

means of brass brackets, as shown in Figs. 4, 5, and 6. Coil A consists of 8 turns of No. 22 double silk-covered wire centered on the tube. The terminals of this coil are brought out as shown in Fig. 1, where they are convenient to binding posts 1 and 2.

Coil B consists of 25 turns on each side of coil A, with the inside ends of the two sections soldered together inside the tubing. The direction of winding makes no difference in any of the coils except that the two sections of coils B and D must be wound so that the current flows in the same direction around the coil from one end to the other.

**T**HE simplest way to fasten the ends of the wire is to drill two small holes about one-quarter of an inch apart where the end of the wire is to come, and pass the wire through and back. The two pairs of holes for the ends of coil B should be one-quarter inch apart and the two holes for ends of coil D, which are nearest to coil A, are naturally the same distance apart.

Only two holes are necessary for the two ends, since they are soldered together inside the tube as shown in Fig. 1. Each half of the winding of coil B is three-quarters of an inch long and you can drill the four holes for the outside ends of coil B on the opposite side of the tube 1 1/4 inches apart.

Tuning unit CD is just like AB, except that all the wire ends are brought out on the same side. Coil C consists of 4 turns of No. 22 double silk-covered wire and coil D is wound with 25 turns on each side of coil C.

After you have mounted the tuning units AB and CD, the sockets J and K and the binding-post strip N with six binding posts screwed to it, all on the baseboard M, as shown in Figs. 1, 5, and 6, you are ready to proceed with the wiring.

The coils AB and CD should be set on the baseboard so that the axes of the coils make an angle of about from 55 to 60

(Continued on page 149.)

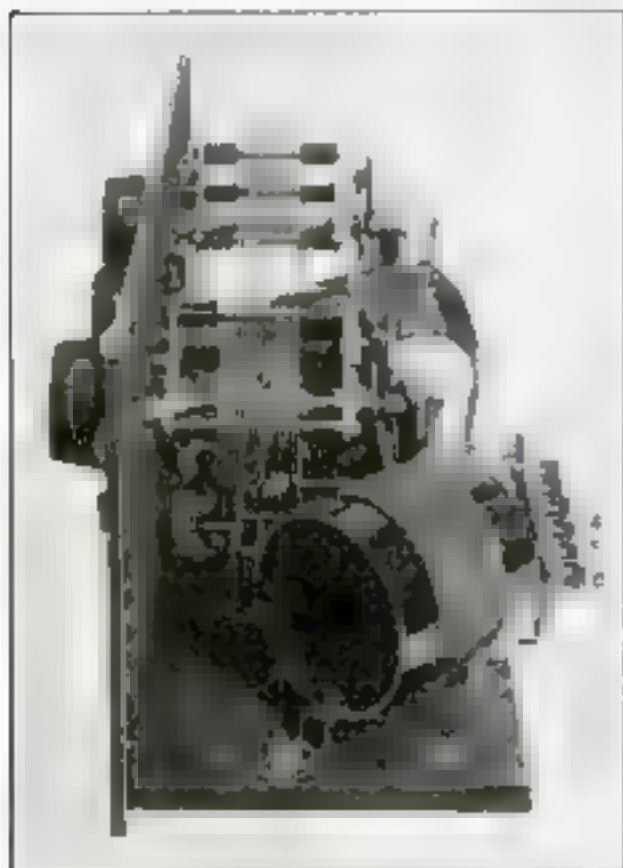


Fig. 5—Right-end view

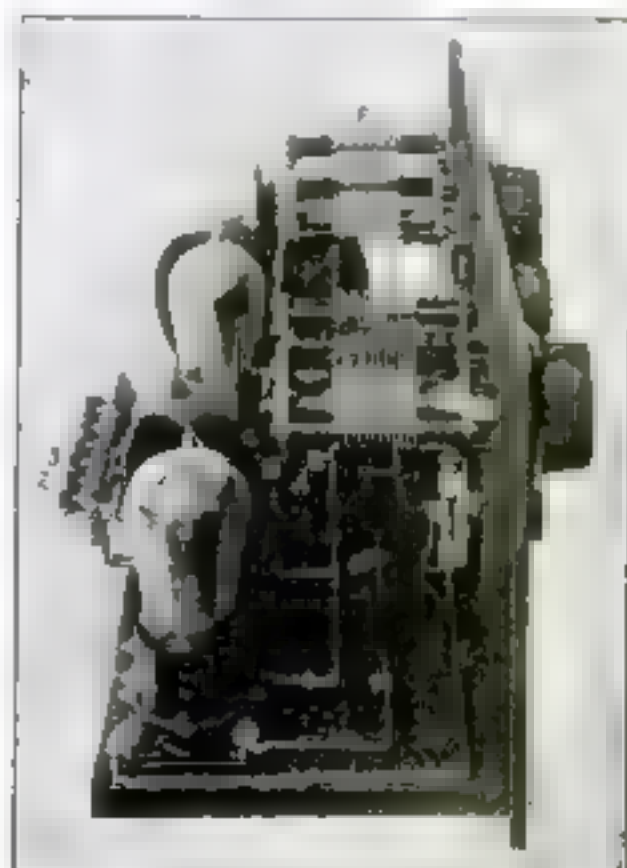


Fig. 6—Left-end view



# Alternating Light Current Will Do the Work of B Batteries

This Filter Circuit Should Cost Less than \$10 to Build

By Alexander E. Senouke, M.E.

**I**N PREVIOUS articles in POPULAR SCIENCE MONTHLY, I have shown how to use farm lighting current and ordinary direct current from the street mains for supplying the B-battery voltage needed by radio receiving sets.

In this article I shall describe how you can use alternating current for the same purpose. This method is relatively more important because the majority of radio fans throughout the country are located where only alternating current is available.

The first step in arranging to use this current for your radio set is to rectify it. Figure 1 gives a good idea of the result of this operation. At the top is a curve representing alternating current supplied to your house, and just below it is another curve showing the current as it leaves the rectifier.

You will note that none of the diagrams show how to use alternating current as a substitute for the A battery.



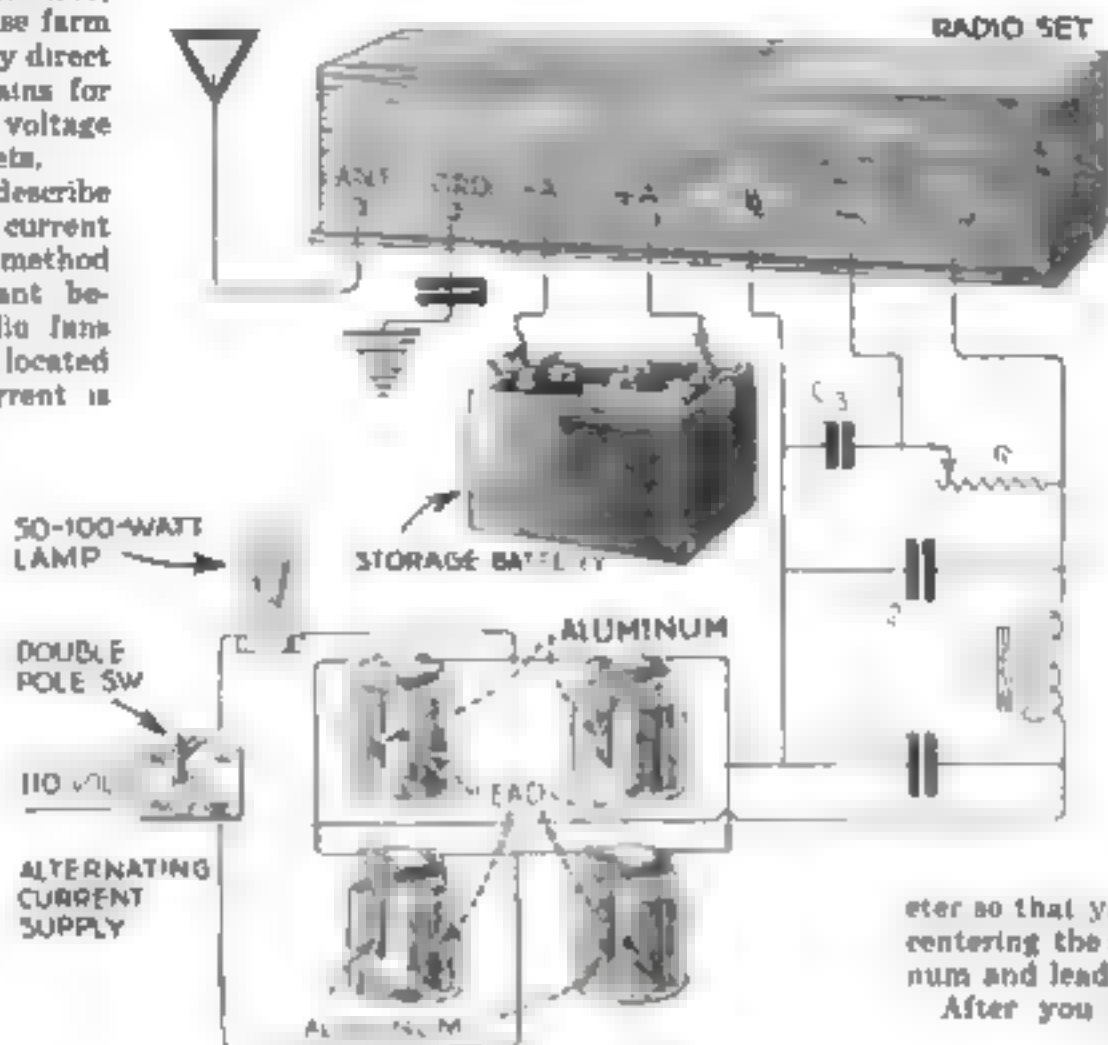
## What the Rectifier Does

Fig. 1—The top curve represents the alternating light current that is supplied to your house, while the lower curve illustrates how it leaves the rectifier as direct current.

as well as for the B battery. It is possible, of course, to build a current-rectifying device that will eliminate all batteries, but the construction of such a circuit is beyond the scope of ordinary amateur work.

Figure 2 shows how to lay out and hook up a complete B-battery eliminator that will work on 110-volt alternating current of 50 or 60 cycles such as ordinarily is supplied for house lighting.

The four mason jar rectifying cells at the bottom of the diagram constitute the rectifier portion of the unit.



## The Hook-Up to Your Set

Fig. 2—This diagram shows how to wire the parts of the rectifier and connect it with your set. The values of the inductance, resistance, and condensers you will need are given in the table at the foot of the page.

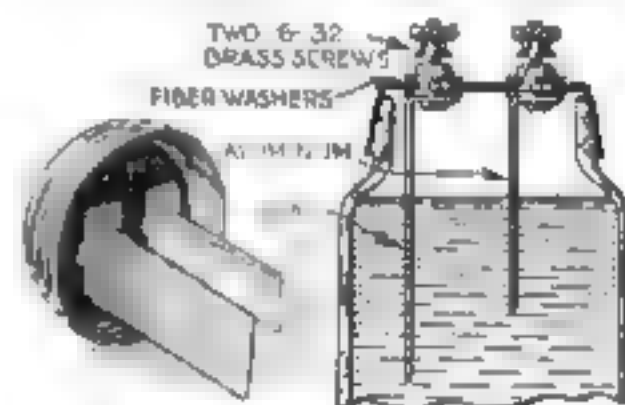
Standard one-pint jars are very satisfactory. The way to fasten the lead and aluminum plates to the cap of the jar is shown in Fig. 3. The aluminum plates should be made of the purest material obtainable and the area of aluminum below the top level of the solution in the jars should not be more than one square inch. The size of the lead plates is not important—two or three square inches of sheet lead will do for each cell.

The solution in the jars should consist of distilled water in which has been dissolved as much ordinary borax as the water will take.

A house-furnishing store will sell you the mason jars, the grocery store keeps borax in stock, and the plumber can supply the sheet lead and the fiber washers, shown in Fig. 3, which are used as insulators. The pure sheet aluminum is not so easy to obtain, but your hardware dealer will put you in touch with a source of supply if he has none in stock. The total cost of the four cells ready for use should be less than one dollar.

**T**HE porcelain lining in the caps of the mason jars should be broken out with a light hammer and then the holes drilled as indicated. Make the holes at least one quarter inch in diameter so that you will have no difficulty in centering the screws that hold the aluminum and lead plates to the tops.

After you have the cells assembled,



## How to Build the Cells

Fig. 3—Standard pint mason jars are used in constructing each of the four cells constituting the rectifier unit. This diagram shows the method of attaching the plates to jar top.

test them to make sure that none of the screws touch the metal of the cap. This can best be done by putting the cap and the screws, one at a time, in series with a dry cell and an ordinary buzzer or bell.

If the bell does not ring, there is no short circuit.

Be sure to drill a small hole about one-sixteenth inch in diameter in the center of each cap to serve as a vent for the gases that form while the rectifier is in operation.

It is not absolutely necessary, of course, to build the rectifier cells in mason jars. They

(Continued on page 27)

## The Values to Use with Your Set

The following table tells you the values you will require for the inductance  $L$ , the condensers  $C_1$ ,  $C_2$ , and  $C_3$ , and the resistance  $R$ , according to the number of tubes in your set.

| Number of Tubes | Inductance of $L$ | Allowable D.C. Resistance of $L$ | $C_1$  | $C_2$  | $C_3$  | $R$                           |
|-----------------|-------------------|----------------------------------|--------|--------|--------|-------------------------------|
| 1               | 20 henries        | 2000 ohms                        | 2 mfd. | 4 mfd. | 2 mfd. | 5000 to 10,000 ohms, variable |
| 5               | "                 | 1500 "                           | 4 "    | 4 "    | 2 "    | " "                           |
| 7, 8, or 9      | "                 | 1000 "                           | 6 "    | 8 "    | 2 "    | " "                           |



# The Month's Novel Radio Ideas

## New Inventions for Receiving Sets and Broadcast Stations

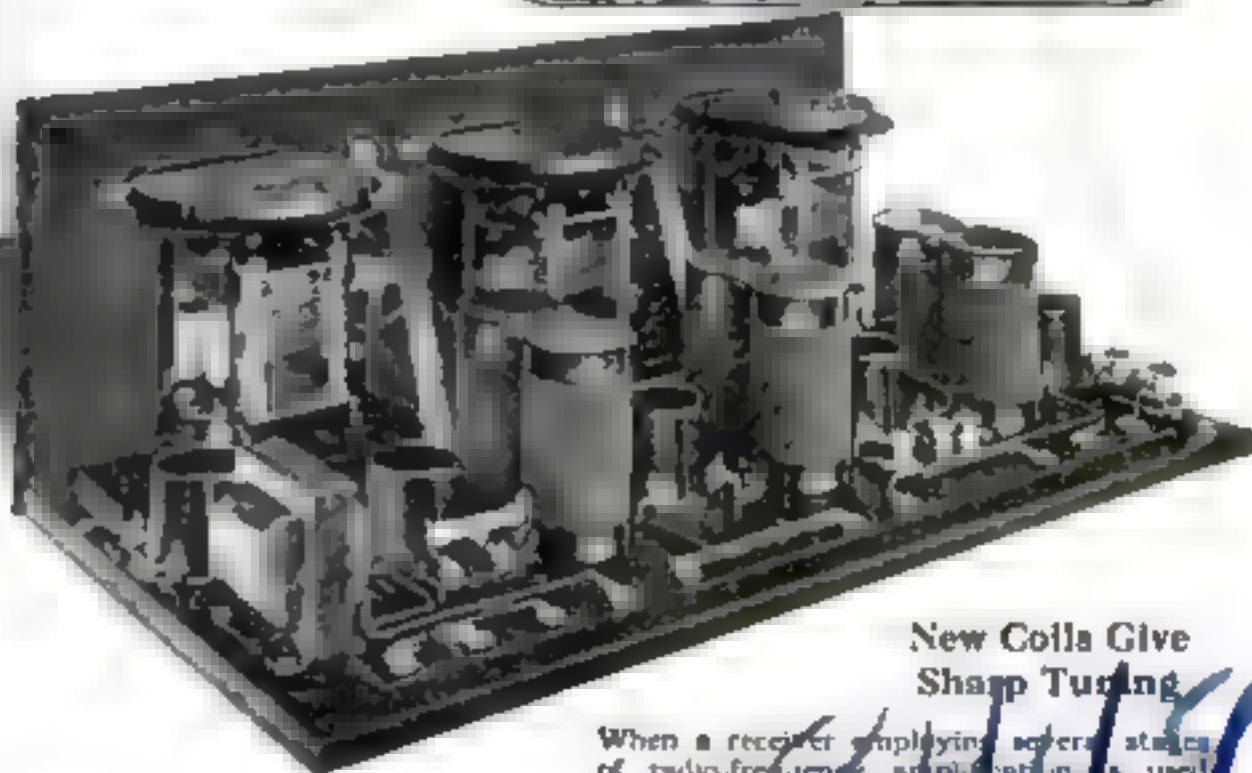
### Tiny Station

Although thousands of amateur radiophone stations use power as low as five watts, WDBX in New York City is the only regularly licensed radio broadcasting station in America with only one five-watt tube to supply energy to the antenna. Samuel McMullen is shown at the relatively tiny control board of WDBX.



### Grandfather's Clock Up to Date

This modern version of the grandfather's clock attracted considerable interest at the first radio show ever held in Germany. It is wound automatically and is set for the German standard time by radio. A loudspeaker for broadcast reception is just below the pendulum, while a receiving set and battery compartment take up the rest of the space in the cabinet. In this view the tall door of the cabinet is open to give access to the neatly arranged radio set.

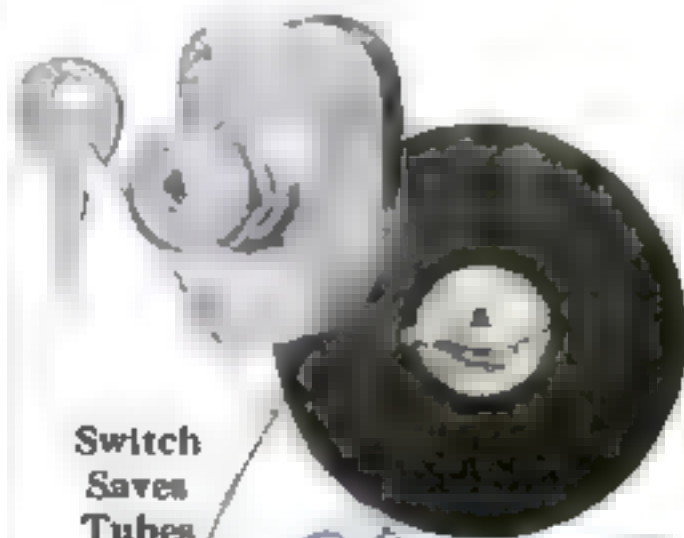
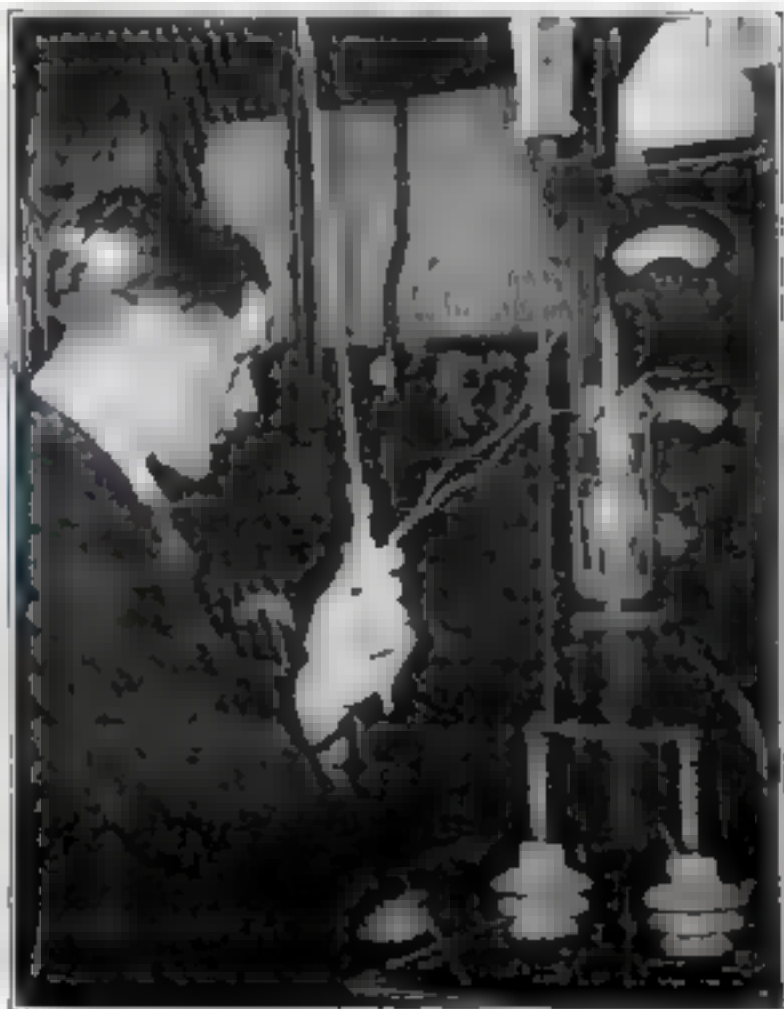


### New Coils Give Sharp Tuning

When a receiver employing several stages of radio-frequency amplification is used near a powerful broadcast station, the coils themselves act as long antennas so that it sometimes is difficult to tune out the local station. One manufacturer claims to have solved this trouble by shaping the coils like a binocular and eliminating interstage coupling. Radio waves reaching the coils, except by the antenna are balanced out.

### Giant Tubes for Overseas Radio

Here is one of the new water-cooled vacuum tubes that are being manufactured for the British Government for use at Rugby, England to be used for radio communication with New York. They are said to be many times more powerful than any tubes now in use. The valves are tested with a current at a voltage of 15,000. The operator stands by with a cord connected with the power supply so that it can be shut off from the tubes instantly in case of an emergency.



### Switch Saves Tubes

Owners of radio receiving sets installed in homes where there are small children will appreciate the advantages of locking up the receiver when it is not in use. This switch lock takes the place of the ordinary switch operated by a button. The key turns off the filament circuit so that the set cannot be used.



# How to Select Your Loudspeaker

An expert helps you choose an instrument that will give undistorted reproduction of radio voices and music

By Arthur A. Stuart

AS FAR as quality of reproduction is concerned, the radio receiver and the loudspeaker are the Siamese Twins of radio. The former converts the high-frequency radio impulses into much more powerful electrical pulsations at audible frequencies. These, in turn, are transformed into sound vibrations by the loudspeaker. If all the radio receiver deliver distorted electrical impulses to the loudspeaker, the result is bound to be poor reproduction. And it is equally obvious that nothing but unsatisfactory speech and music can come from a low grade loudspeaker, no matter how perfectly the radio receiver itself performs its functions.

People who possess an ear for music naturally are in a better position to pass on the musical quality of a loudspeaker. It is unfortunate that some radio dealers apparently have no ear for music at all, judging from the raucous blare they persist in sending out over the public streets by way of loudspeakers installed in transoms over doors. In almost every case of this kind, quality has been sacrificed in order to attain the maximum volume, and the ears of passing pedestrians are assaulted by a noise well calculated to drive any thought of owning a radio receiver out of their heads.

This brings out one point that is important—you cannot always rely on the dealer's opinion as to the best loudspeaker. It is a question you must decide for yourself, and if you have no ear for music you should call in some friend who has the ability to help you.

The advice of any reliable radio dealer can be depended on with respect to all other items of your radio equipment if you will tell him exactly what you want in the way of results, for the factory-made receivers of today are nearly all capable of excellent results as far as quality is concerned.

Perhaps the first question to be decided is the matter of volume. Do you want to fill the house with music or will you be satisfied with enough volume so that you and your friends can hear

clearly if you are in the same room with the loudspeaker?

This is a vital point, for upon it hinges the amount of money you will have to

attempt to get the music or speech loud enough to be heard all over the house, distortion has to be compensated for in every possible way—and this means careful design, precise manufacturing methods, and much testing and adjusting. Naturally the cost of such loudspeakers is high.

It is claimed by experts that a good pair of head phones costing less than \$10 will give you as good, if not better, reproduction than can be obtained from the very finest loudspeaker money can buy. This is because the head phone is called on to give out sound vibrations of relatively small magnitude.

To understand what causes the distortion, it is necessary to know something of the mechanism used to transform the electrical impulses into sound vibrations in the air. The head phone is the simplest example. It consists of a permanent magnet arranged so that the poles of the magnet exert a constant pull on a thin disk of iron called the diaphragm. Coils of fine wire are placed on the poles of the magnet in such a way that

the magnetic effect of the electrical impulses from the radio receiver change the pull of the permanent magnet on the diaphragm and it moves back and forth in time with the electrical impulses. The vibration of the diaphragm is what causes the sound waves in the air.

The permanent magnet naturally exerts the strongest pull on the diaphragm if placed very close to it, and this fact accounts for some of the distortion. Strong electrical impulses cause the iron diaphragm to vibrate so far that it bumps against the ends of the pole pieces with a chattering sound, and if the spacing is increased, the weaker impulses are lost altogether.

Many loudspeakers are equipped with an adjustment to regulate this spacing to compensate for loud signals, strong plate current, and so forth. In a number of models, the diaphragm is made of mica or aluminum connected with a small piece of iron, called the "armature," placed in the field of the permanent magnet. The connection

CONTINUED ON PAGE 148



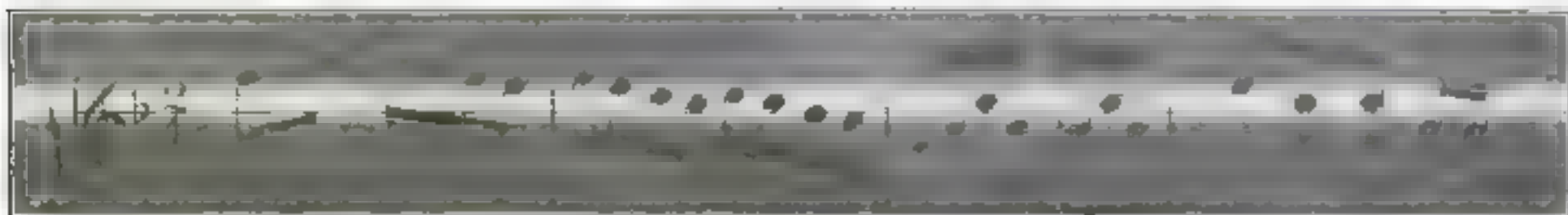
You can judge whether a loudspeaker produces good quality by listening with head phones on the detector stage then listening to the loudspeaker and comparing the two.



A typical homemade loudspeaker consisting of an old phonograph horn to which is attached a single head phone. Such an outfit will give excellent quality of tone at low volume.

spend for a loudspeaker. Volume and quality do not go hand in hand. High quality with small volume is relatively easy to attain, but the minute you

need a loudspeaker. Volume and quality do not go hand in hand. High quality with small volume is relatively easy to attain, but the minute you



Beware of the loudspeakers that over-emphasize a few notes on the musical scale or a few tones in the human voice.



# What Does "Low Loss" Mean?

A much-abused radio term explained to safeguard you against inferior parts parading under false colors

By John Carr

SOME time ago, back in the dark ages of radio, a young man who was interested in amateur radio transmission and reception on the shorter waves, made a serious attempt to design a radio receiver for use on these waves with the idea of reducing some of the losses that were hampering his reception of distant signals.

He succeeded in working out a receiver that gave uncommonly good results, and in describing his outfit for one of the radio magazines, he hit upon a brilliant thought. He called it a "low-loss" receiver. Other amateurs experimented along similar lines, and before long "low-loss" construction was the main subject of conversation in amateur circles.

Manufacturers of radio apparatus quickly saw the advertising possibilities of such a catch phrase, and new pieces of radio apparatus designed for use on the broadcast wave lengths began to appear on the market tagged with the mystic words, "low loss."

Radio fans were interested at once, and soon it looked as if no maker of radio apparatus, regardless of the quality of his product, could possibly stay in the radio game unless he, too, brought out a line with the magic slogan on the boxes. And that condition exists today in spite of the fact that a number of the parts now on the market labeled "low loss" have no more rightful claim to the label than the man in the moon.

THERE is no mystery about the "low-loss" idea. A "low-loss" condenser is simply one that performs its electrical functions in a highly efficient manner. Because a variable condenser has metal end plates and a grounded rotor does not prove that it is electrically efficient. As a matter of fact, it may actually have greater losses than a condenser with molded end plates. Care in construction and the quality of the materials used are more important than any particular style.

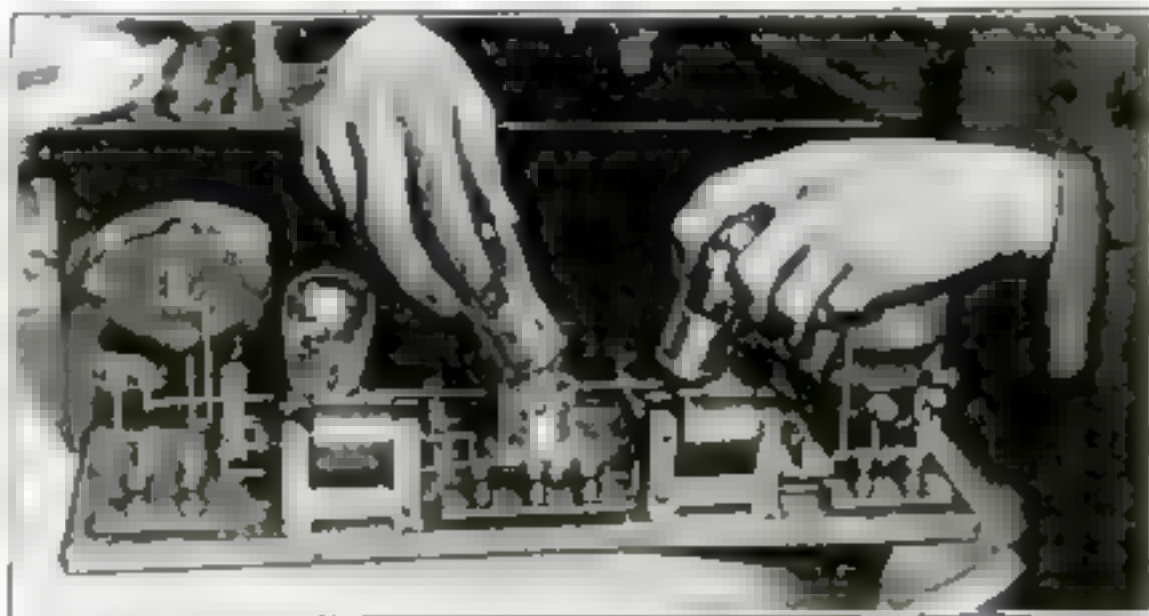
Every new model brought out by a reputable manufacturer is quickly followed by a number of imitations. Outwardly, at least, two condensers may appear to be equally good, but one condenser may be insulated with the best material obtainable, while the imitation contains insulation like the original only in color and finish.

Spacing washers may be turned out by screw machines with perfectly flat,

smooth surfaces on both sides, or they may be punched out in a press, with the result that they are burred on one side and bent on the other. After assembly, the punched washers are polished on the outside and they look well to the prospective buyer, whether they are making good contact with the plates or not.

The qualities that entitle a variable condenser to be called "low loss" may be stated in a few words: Good insulation in the right place and not too much of it,

minimum amount of supporting insulation, and actually live up to the claims of the makers. Others are "low loss" in name only. They are wound with a poor grade of wire, often with defective insulation, and with metal braces in the wrong place. The various forms of basket-weave coils have attained a considerable degree of popularity lately, but you can bank on it that the product of any of the reliable manufacturers will bring in the signals provided the other parts in the receiver are right.



How Not to Build Your Receiving Set

The receiver pictured above is a typical example of what not to do if you want your set to be of "low loss" design—one that will bring in signals as clearly and as loudly as possible. Notice that the tuning coils are

placed at one end of the panel and the tuning condenser at the other, with two-stage amplifier between them. While this arrangement looks well from the front, the long leads in the secondary circuit produce distortion

accurately spaced plates making good contact with the shaft and fixed support, and rigid bearings.

The matter of bearings, by the way, is important both electrically and mechanically. We must rely on them to maintain the moving plates in permanent alignment with the stationary plates, and no condenser can be rated as first class unless the bearings have absolutely no sidonor and play. Otherwise it will be impossible to be sure of always hearing the same station at the same point on the dial.

Good bearings also are of great importance in the actual operation of a receiver. A bearing that turns with a smooth, velvety motion makes close tuning possible without Vernier dials.

THE condensers made by reputable manufacturers vary somewhat as to electrical efficiency, but the differences are so small that even the poorest one of the lot still would bring in any signal that could be heard by the best one.

Nearly all tuning coils and inductances of various kinds now are labelled "low loss." And many of them are really exceptionally efficient. They are wound with the finest grade of wire, use the

minimum amount of supporting insulation, and actually live up to the claims of the makers. Others are "low loss" in name only. They are wound with a poor grade of wire, often with defective insulation, and with metal braces in the wrong place.

If you want to know what metal does when placed in the field of a tuning coil, just hold a tobacco tin flat against the end of the coil when the set is in operation and see what happens to the signals!

AFTER all, a "low-loss" receiving set is one that brings in the signals as clearly and loudly as possible. To gain the advantages that are inherent in "low-loss" parts, the amateur builder should be willing to sacrifice appearance to have the instruments placed most efficiently.

Perhaps one of the worst examples of poor design is the practice of arranging the tuning coils at one end of the panel and the tuning condenser at the other, with a two-stage amplifier located in between. Such an arrangement looks well from the front, but what can be said of the long leads in the secondary circuit? Distortion is almost sure to occur because of the capacity effect between the long connection with the grid of the detector tube and the audio-frequency wires, which often parallel it for many inches.

AND this is a very important point. You can take a really "low-loss" condenser, a correctly designed tuning unit, and sufficiently high grade parts to build a receiver, and yet if you place the parts in the set in the wrong position with relation to each other, you will lose all the value of the "low-loss" construction in the individual units.

In the first place, do not build a receiver in which the tuning coils are so placed that any large mass of metal is near the open ends of the coil. If you place a good "low-loss" coil against the condenser plates, for instance, it

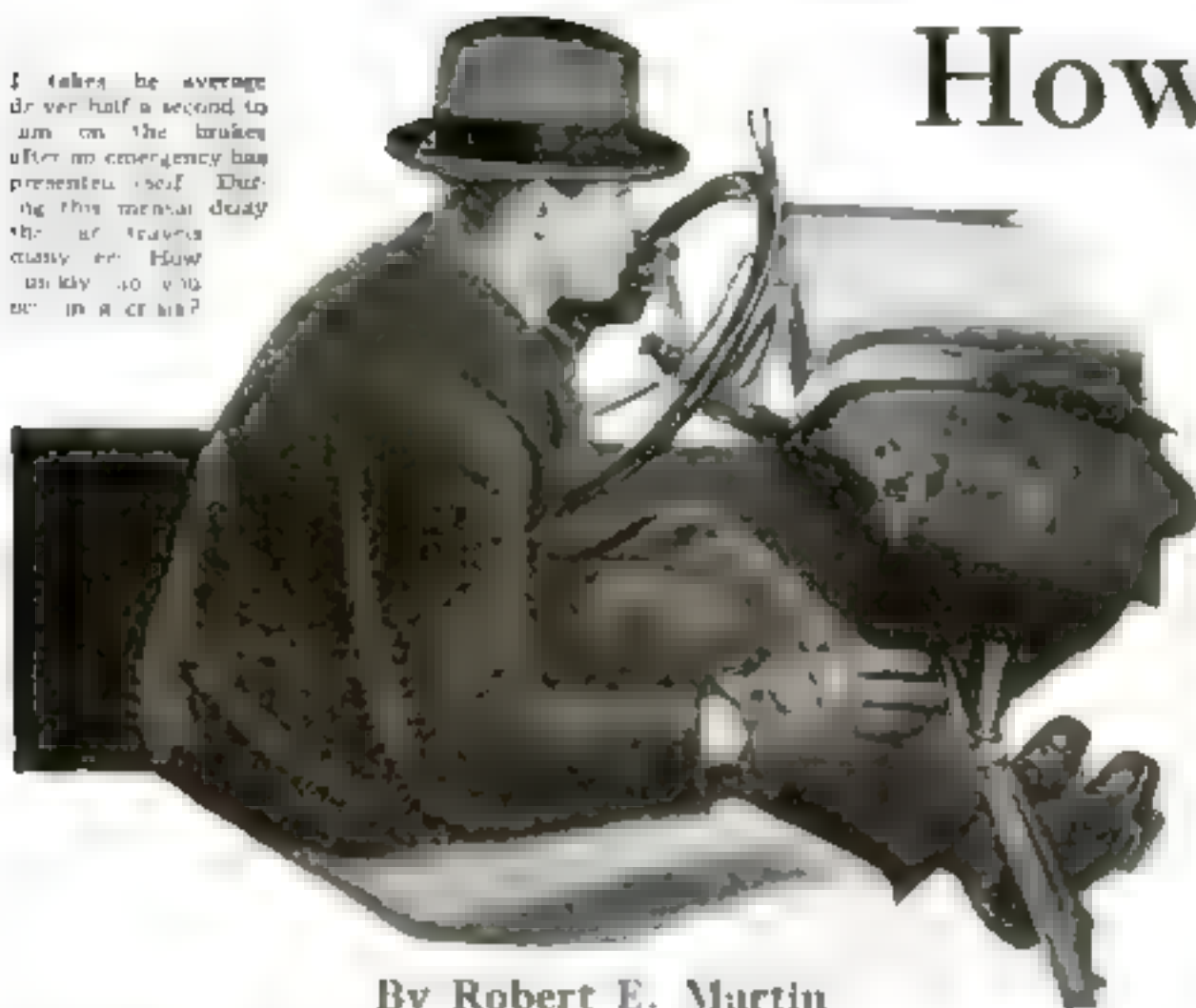
will have far higher losses than the worst coil properly placed. An audio-frequency transformer produces an effect that is even worse than condenser plates when placed in the field of the coil.



# How Quickly Your

## Bureau of Standards to Test Your

It takes the average driver half a second to jam on the brakes after an emergency has presented itself. During this mental delay the car travels 22 feet. How quickly do you stop in a crisis?



By Robert E. Martin

**S**UPPOSE you are driving an automobile at 30 miles an hour. Apparently the road is clear, when suddenly a siren shrieks and a fire-truck thunders from a side street directly into your path.

How quickly can you stop?

If your car is equipped with four-wheel brakes in perfect condition, you probably can bring your machine to a standstill within about 38 feet. And you will be borne out in this, apparently, by recognized charts of braking performance. But actually, can you? You may know that your car's braking mechanism will respond instantly to your foot on the pedal. But what about the speed of your mental machinery? How quickly, after your mind senses an emergency, can you jam on the brakes?

The answer to this question, as the result of recent discoveries by the U. S. Bureau of Standards, suddenly is revealed as a factor of tremendous importance in the appalling toll of death and injury from traffic accidents. For these discoveries, made with ingenious new measuring instruments, have demonstrated the surprising fact that for the average driver an interval of at least half a second elapses from the time he senses a warning of danger until he can jam on the brakes. And in this half-second interval of delay a car speeding at 30 miles an hour will travel a distance of 22 feet before the brakes are applied!

**I**N OTHER words, instead of being able to stop your car with four-wheel brakes within a distance of 38 feet, as you believe, the distance actually will be nearly 60 feet, if you are an average driver. And if you are below the average in quickness of mental response, the distance will be even greater.

These amazing new measurements of the mental slack in relation to safety on the road are more than substantiated in American traffic courts, where, every day, comes tragic evidence of the mental

**YOU** are driving along at, say, 30 miles an hour. A shriek from a siren! A fire-truck darts out from a side street!

How fast do you apply your brakes?

"Instantly," you answer. You are wrong.

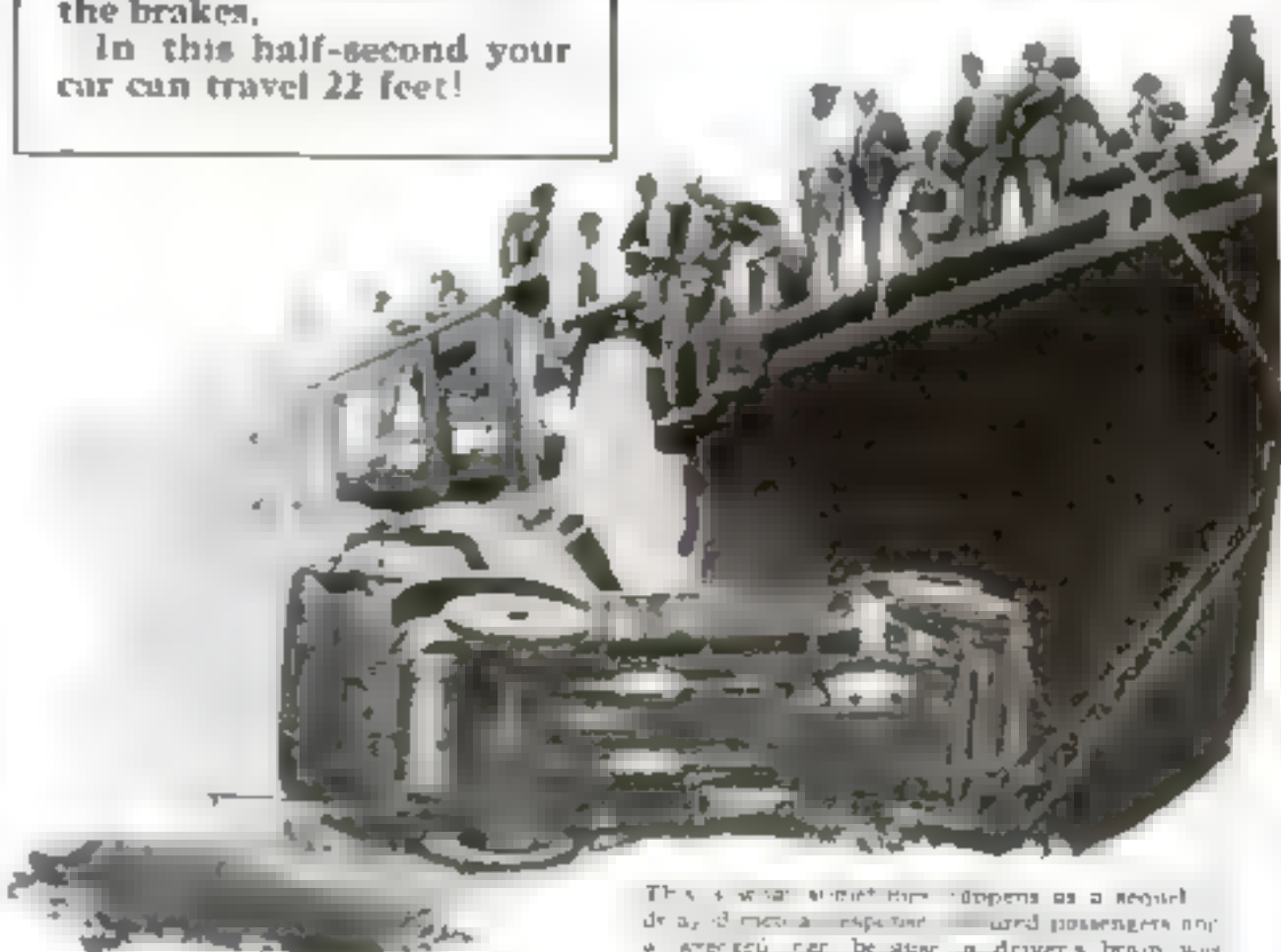
The Bureau of Standards, investigating the "mental slack" of motorists, finds there is an interval of almost half a second between the time an emergency calls for brake action and the time most of us actually apply the brakes.

In this half-second your car can travel 22 feet!

paralysis with which motorists are afflicted in the face of emergencies. There collisions and wrecked lamp-posts pass in constant review before the judge on the bench. There the drivers of automobiles appear at their worst—drivers whose mental alertness has been put to the test and has been found wanting.

**A** BALTIMORE judge recently told me of a man who was driving his car with the stream in a crowded street. A movement of cross traffic had just ceased, and the motorist moved ahead with his mind settled upon the idea that for several blocks he would enjoy uninterrupted progress before he would be stopped by the next intersecting stream of traffic. Normally this state of mind would have led him into no difficulties. But in this particular case, he encountered the unexpected in the form of fire apparatus speeding directly across his path.

There was no failure of signals and no lack of warning—a fact that was shown by the circumstances that all the cars behind this man came to an immediate stop. He was the one driver who failed. Not until he was within striking distance of a fire-engine did he attempt to apply his brakes. By this time, of course, his efforts were useless, and a bad smash resulted. Slow thinking cost the man severe injuries, a seven-passenger car, and traffic-court discipline. And there was nothing wrong with his brakes.



This is what sometimes happens as a result of mental paralysis. —and passengers may be saved only by a driver's brain which has a second late in responding to an emergency!



# Can You Stop Car?

## Devises New Ways Mental Speed

Just how slowly his mind responded was clearly established by the distance between the point of collision and the spot at which full stop was reached by the car immediately behind his own. This interval of clear space measured 36 feet, proving that he had ample time to apply his brakes and halt his car. His mind had not remained frozen. The explanation, in court, was that he had expected a clear channel and had not "taken in" the peremptory warning of the approach of the fire apparatus.

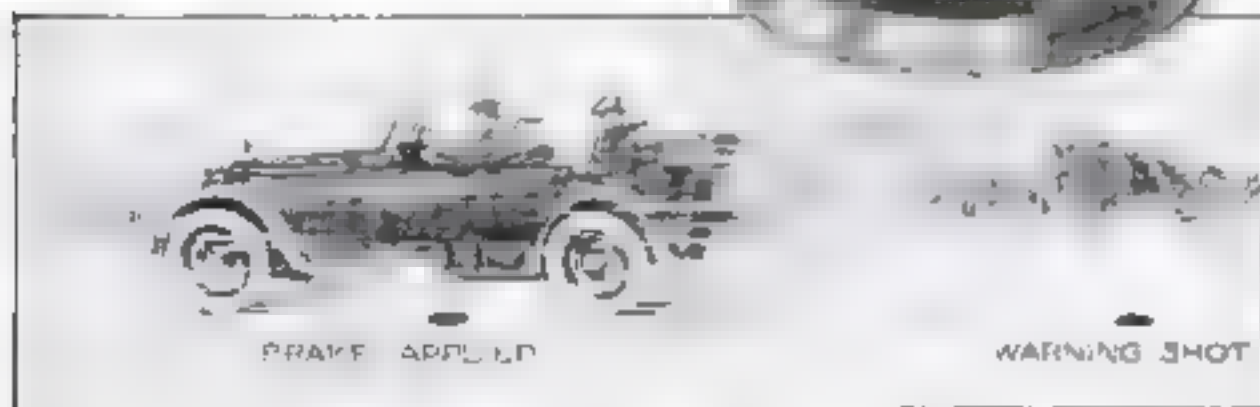
Incidents such as this might be cited without number. Again and again a valuable fraction of a second lost while the slack mind is registering an impression is sufficient to carry a car to disaster that might have been averted. Meanwhile the automobile death list grows, from more than 16,000 in 1923 to more than 18,000 in 1924.

The research of psychologists has shown that mental slack is as definite as

the sag in a towrope or in the couplings of a freight train. In each case there is lost motion. The captain of a tugboat knows, from experience, how far he must travel before the sag of his line is taken up. Likewise, the locomotive engineer, from his cab, can judge with equal accuracy when his train is pulling smoothly. Now science has applied actual measurement to the



An official of the U. S. Bureau of Standards making a brake test with the decelerometer, a new instrument that measures the time required to stop a car. At the left is a close up of the instrument, without its case.



The pistol test of mental delay. Bullets of red lead mark the roadway, providing a means of measuring the distance traveled between the warning shot and application of the brakes.



A car with four wheel brakes, traveling 40 miles an hour, can be stopped within 38 feet after the brakes are applied. But, because of a variation which is the average half-second interval of mental slack between a warning signal and application of the brakes, the car was travel 22 feet

time required to take up the slack in human thought processes. In the Bureau of Standards tests, government scientists are making available to every motor-car driver valuable new measurements that will give him more intelligent control over his car and assure him greater safety.

The apparatus used in the tests employs two pistol shots fired from a moving automobile. The first pistol is fired by a judge or inspector riding behind the driver. It represents a danger signal—a peremptory command to apply the brakes. In response, the driver jams on the brakes as quickly as he can, and the pressure of his foot on the brake pedal automatically fires the second pistol.

Each bullet, fired downward from the car, is made of litharge, or red lead, which produces a red mark on the roadway. The two splashes of litharge tell the story of the driver's mental alertness or laxity, for the distance between them represents the travel of the car during the time he spent thinking about applying the brakes and in moving his foot to the pedal. In addition, the time required to bring the car to a stop and the rate of slowing down are measured by a recording decelerometer, an ingenious instrument designed especially for the purpose by engineers of the bureau.

In the Washington tests the quickest time for any driver was a quarter of a second, the slowest was six-tenths of a second, and the average was close to half a second. The best showing was hardly to be counted, for the reason that the driver had his foot on the brake pedal at the firing of the first shot. In all the other

(Continued on page 147)



# Shortcuts for Car-Owners

## Simple Light Holder

**W**HEN working on your car at night, you often wish you had an extra hand to hold your pocket flashlight. With the little device shown in Fig. 1, the lamp may be clamped on your head so that the beam of light is kept automatically on the spot where you are working. The flashlight is held in a clip made from strong wire fastened with four rivets to a small piece of sole leather. This in turn is riveted to a skate strap. When some inaccessible spot is to be reached with a screwdriver, the lamp may be strapped on the wrist.—F. S. Root, Fall River, Mass.



Fig. 1—Strip and wire clip hold flashlight in best position for illuminating the work

**A**LTHOUGH spindle-body bushings frequently need replacement, the removal of the old bushings often prevents the job from being done in the home garage. One carowner, however, makes use of the method illustrated in Fig. 2. A saw cut about 1/8" deep is made in an old spindle bolt, which then is inserted in one end of the spindle body and pushed to the lower end of the opposite bushing.

The head of the bolt is placed on an anvil, and a small chisel or wedge is driven into the saw cut so that the spread end will engage the end of the bushing. A few hammer blows on the bolt head removes the bushing. The opposite bushing is removed in the same way and new bushings are driven into place and filed off to fit the yoke.—HAROLD N. WHITMORE.

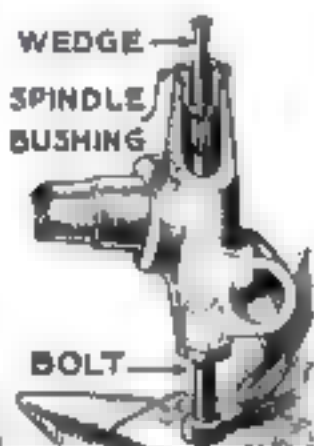


Fig. 2—Removing spindle bushings

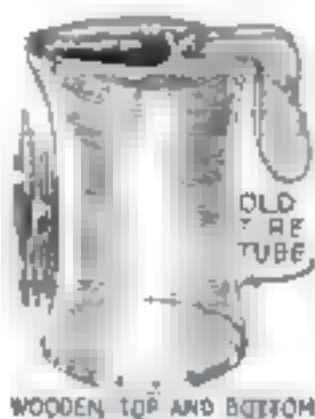


Fig. 3—Old tire prevents radiator blanket from being blown off in a high wind



Fig. 3—Old tire prevents radiator blanket from being blown off in a high wind

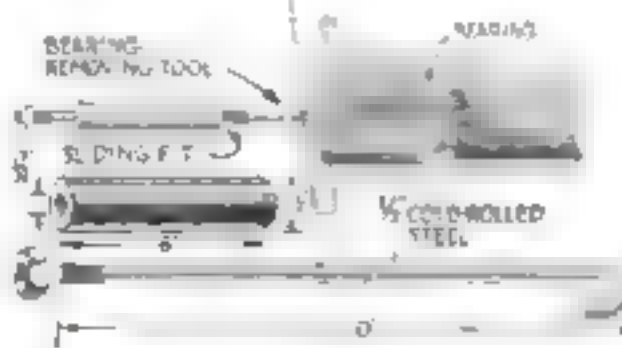


Fig. 4—Tool for extracting ball-bearing races

hole and tightened it with my clamps. Then I saturated a length of cash cord in gasoline, laid it on top and lit it (Fig. 4). This made a serviceable repair.—OSCAR M. ANDERSON, Tacoma, Wash.

**A** COLLAPSIBLE pitcher for fixing automobile radiators can be made as shown in Fig. 5 from a section of old inner tube fastened with a few tacks to a wooden top and bottom. The top should be an inch or more in diameter than the tube so that the rubber will have to be stretched over them. This pitcher takes up little room in the toolbox, but is exceedingly handy in an emergency when the radiator requires filling on the road.

## Speeds Night Repairs

**T**HE auto repairman often is confronted with the problem of extracting ball races or bearings that are seated inside housings and cannot be driven out by the usual means. When such parts are too tight to drive out, they can be removed by the use of the tool illustrated in Fig. 6. The hook is placed behind the part to be pulled out and the sliding handle is used as a hammer.

**I**N AN emergency it is sometimes valuable for the owner of a Ford car to know that the nut that holds the front spring perch on the front axle will interchange with the nut holding the rear wheel on either of the rear axles. If one of the rear axle nuts becomes stripped, it will not hold the wheel. By shifting the nut from the spring perch to the rear axle, however, and placing the damaged nut on the spring perch, the car still can be used. Cover-pins are inserted in both nuts and if the spring perch does not seem secure, it can be wired temporarily.—G. A. L.



Fig. 4—Making a long tube patch



Fig. 7—Nut for axle

tar and resin melted together and applied with a brush while warm.

**A** CHEAP and effective method to economize gasoline consumption in a Ford or other light car is to drill and tap the intake manifold with a 3/8 in. pipe tap and install a small whistle valve. Such a valve has a spring to keep it closed. A wire is run to the dash so it can be opened to let an extra supply of air in, especially when running smoothly over a good road on long trips.—JAMES ELLIS.

**A**FTER soldering an auto radiator, it is a good plan to cover the new work with banana oil or shellac to close air holes.

**M**ECHANICS who park their cars outside a factory or building under construction from morning till night often find that a blanket thrown over the engine has been blown partly or entirely off and the engine has been damaged. As appearances usually do not matter, it is a simple thing to use an old tire as shown in Fig. 3; to hold the blanket over the engine. At night the tire section can be thrown into a corner of the yard for use on the next cold morning.—L. B. ROBBINS, Harwich, Mass.

**O**N ONE occasion when my regular tube repair kit was not large enough to repair a long blowout, I laid the tube on a piece of straw, placed a cement and repair rubber in position, covered it with wax paper, put a piece of tin over the





# The Home Workshop

Arthur Wakeling, Editor

## Giving Wings to Your Speedster

### How to Improve the Racing Quality of a Light Sport Car

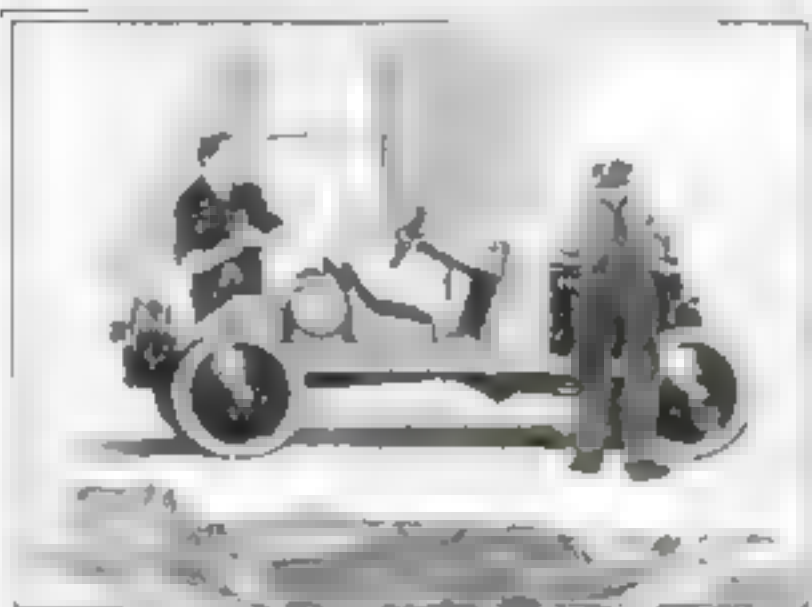
By George Arthur Luers

Automotive and Mechanical Engineer

**C**ONVERTING a Ford or other light car into a sporty-looking speedster is one of the most fascinating tasks undertaken in the home workshop. How many thousands of speedsters are built each year cannot be estimated, but their construction comprises the greater proportion of really elaborate projects undertaken by amateur mechanics.

So far as appearance is concerned, success usually rewards the builder of a sport car. A racy, ready-made body can be purchased, as well as wire or disk wheels and the various accessories that insure constructing a good-looking sport car. The difficulty often is, however, that the car's road performance does not live up to its looks.

How to add speed to your speedster is the real problem when building a sport car. It also is the most interesting problem. Whether you already have con-



Properly remodeled, a cheap light auto can be made fast and dependable on the road as well as distinctive in appearance like the sport car illustrated. Note the aluminum instrument board.



a low-tension magneto, each coil emits a series of sparks for each explosion in the cylinder. It is apparent that after the first spark ignites the explosion, the successive sparks are of no use. While this system is satisfactory for slow and moderate speeds, it will be seen at once that a multiplicity of sparking is not sufficiently accurate when the engine is turning over at 2000 or more revolutions a minute.

A speedster normally is fitted with a starting and lighting battery. This leads to the use of a single spark system of ignition, which gives a single hot, live spark for each explosion. Such a spark can

be timed accurately to occur at the correct point in the compression and it acts uniformly for each period of engine rotation.

Equally good results are to be obtained with a high-tension magneto. A magneto of this type, with complete fittings, can be had for attaching

to the timing gear in the front end of the motor or to the end of the camshaft after the regular roller commutator assembly has been removed.

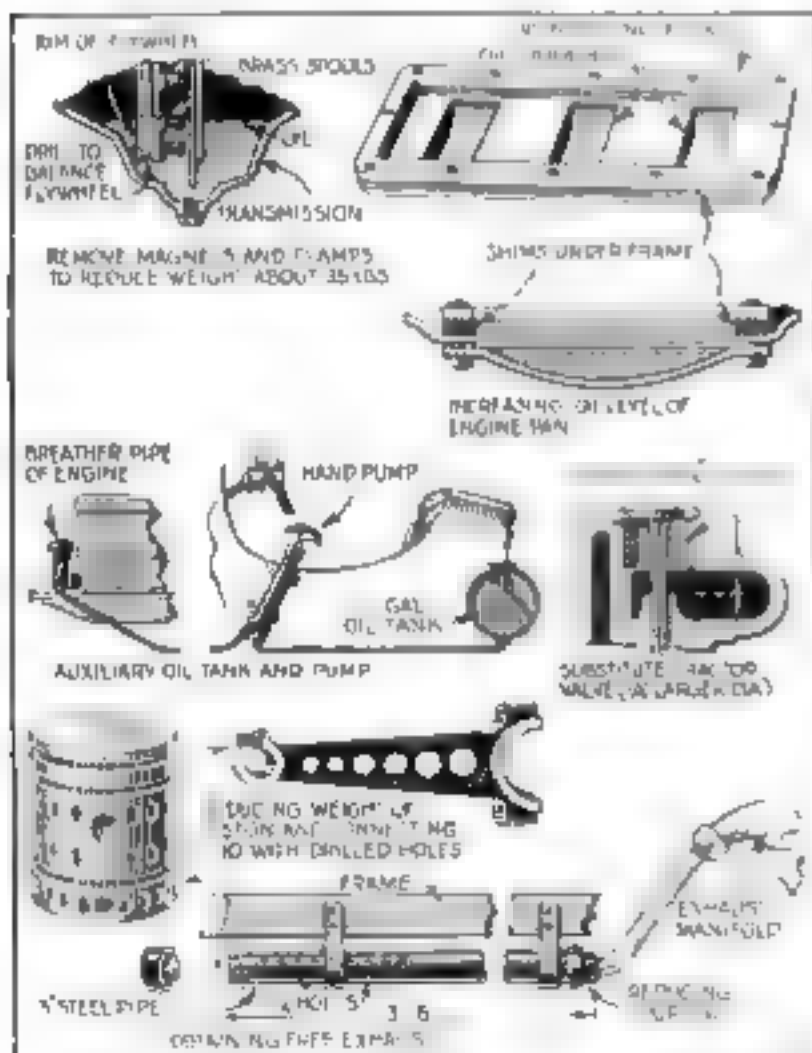
The low-tension magneto should be removed unless the coils are used for lighting purposes, when no battery is pro-

(Continued on page 120.)

structed a speedster or are planning to build one, it will pay you to make use of as many as possible of the following suggestions in remodeling the engine.

On a fast highway you can hope to outdistance other cars only when engine conditions are just right. To get the necessary increase in engine revolutions, the engine balance, ignition, lubrication, cooling system, and all other factors must be designed and adjusted properly.

About 75 per cent of speedsters are remodeled Fords. Since a Ford has four separate coils operated from



How to reduce the weight of engine parts, enlarge the valves, improve the lubricating system, and reconstruct the muffler.

### Where to Find This Month's Mechanical Features

The Home Workshop  
Pages 83 to 123

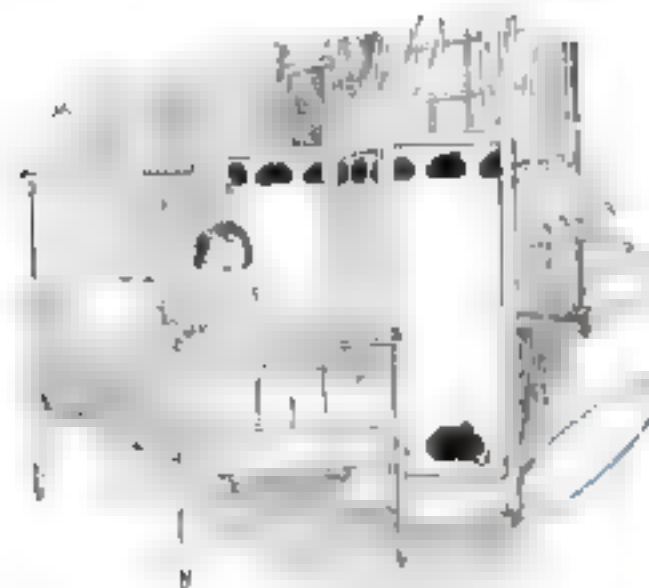
The Shipshape Home  
Pages 124 and 125

Better Shop Methods Department  
Pages 88 and 126 to 136



# A Folding Screen for the Nursery

Has light panels of enameled wallboard ornamented with rabbits



By A. Neely Hall

Specialist on Handicrafts  
in the Home

A SCREEN is useful in the bedroom for several purposes, among which may be mentioned the shielding of the bed from draft from an open window and from glare of morning sunlight. It is an essential part of nursery furnishings, yet often is one of the last things provided because of the cost. To the father handy with tools, making a screen is no trick at all.

The framework of the threefold nursery screen in the photograph is of 1 by 2 in. strips, which can be purchased at any lumber yard. The panels are of wallboard, obtainable from the same source. Wallboard serves well for paneling, and is easier to obtain in wide pieces than wood, which usually must be veneered if wider than 12 inches. It is more desirable for nursery use than any textile because it can be enameled and thus made washable and sanitary.

Number 1 of the mechanical drawings gives dimensions for the framework of the screen, and 2 and 3, details of the stiles and rails. Note that the strips are grooved to receive the edges of the panels, also, that they are mortised and tenoned. If you have no dado plane with which to make grooves, use a  $\frac{3}{4}$ -in. chisel. It is

easy to cut them. Make the grooves at least  $\frac{1}{2}$  in. deep. On the edges of the panels, the grooves mortise and tenon with glue, and after drying reinforce the glued joints

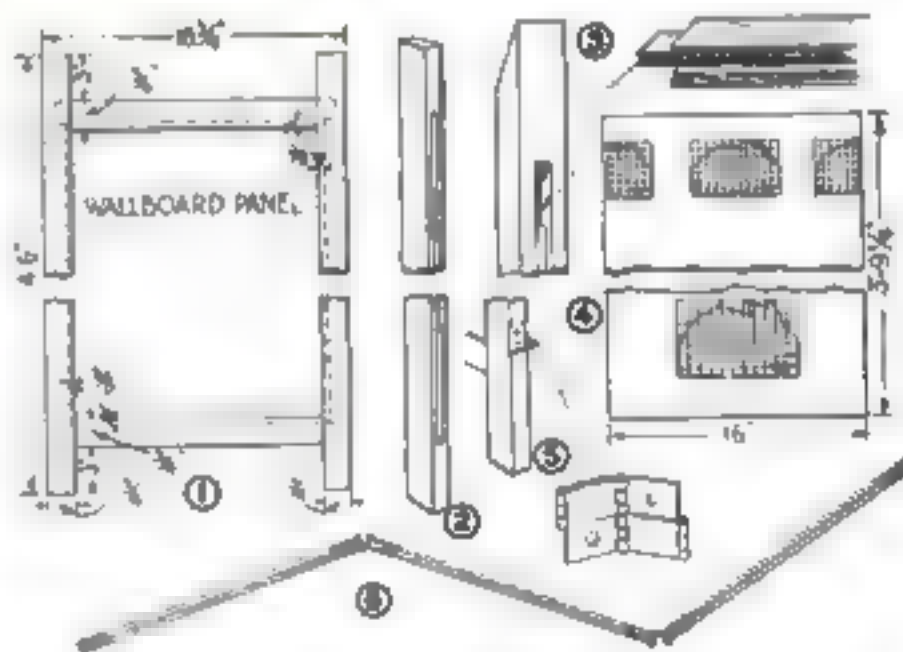


A screen that is easy to keep clean

with finishing nails.

Ordinary hinges may be used for hinging the frames of the screen, but they fold only one way. A better hinge is the double-acting type shown in 5 and 6. Notch the edges of the stiles to admit the flaps of the hinges.

After fitting the hinges, remove them until you have finished the frames. Two coats of flat white and one or more coats of white enamel should be applied.



How the framework is put together with mortise and tenon joints. Details of the wallboard panels and a double-acting screen hinge

## Large Clothes Rack May Be Built Cheaply

TO INSURE quick drying, a clothes-rack must be designed to allow the air to circulate freely around the clothes. The rack illustrated is large enough to insure this and at the same time it is so built that it can be placed around the stove, hot-air register or radiator. If only a few pieces are to be dried, it need not be unfolded fully. When not in use it collapses flat.

In building one section of the rack, fasten one end of each horizontal bar or strip to one of the uprights with long, round-head wood screws. The other upright is grooved at corresponding intervals so that screw hooks turned into the ends of the horizontal members may be placed in the grooves and bent to form a sort of screw-eye fastening. These screw-eyes are loose enough to act as hinges.

As many sections as desired may be built and connected, as shown in the accompanying photographs.—J. J. BYBERG.

The clothes rack is made of wood and fabric. It is built so that it can be placed around the stove, hot-air register or radiator.



SCREW HOOK BENT TO FORM EYE

## Pump Repaired with Rubber

FARMERS and others who depend on a well for their water supply often have considerable trouble because their pumps "run down" and have to be pumped every time water is wanted. This trouble usually can be remedied at practically no cost other than taking the pump apart.

From a piece of old inner tube or patching stock, cut a piece the same size and shape as the flap on the lower leather check valve. Attach the rubber to the upper side of the valve flap with the bolt or screw that holds the iron valve weight. Be sure the rubber is as large as the flap. Then put the pump back.

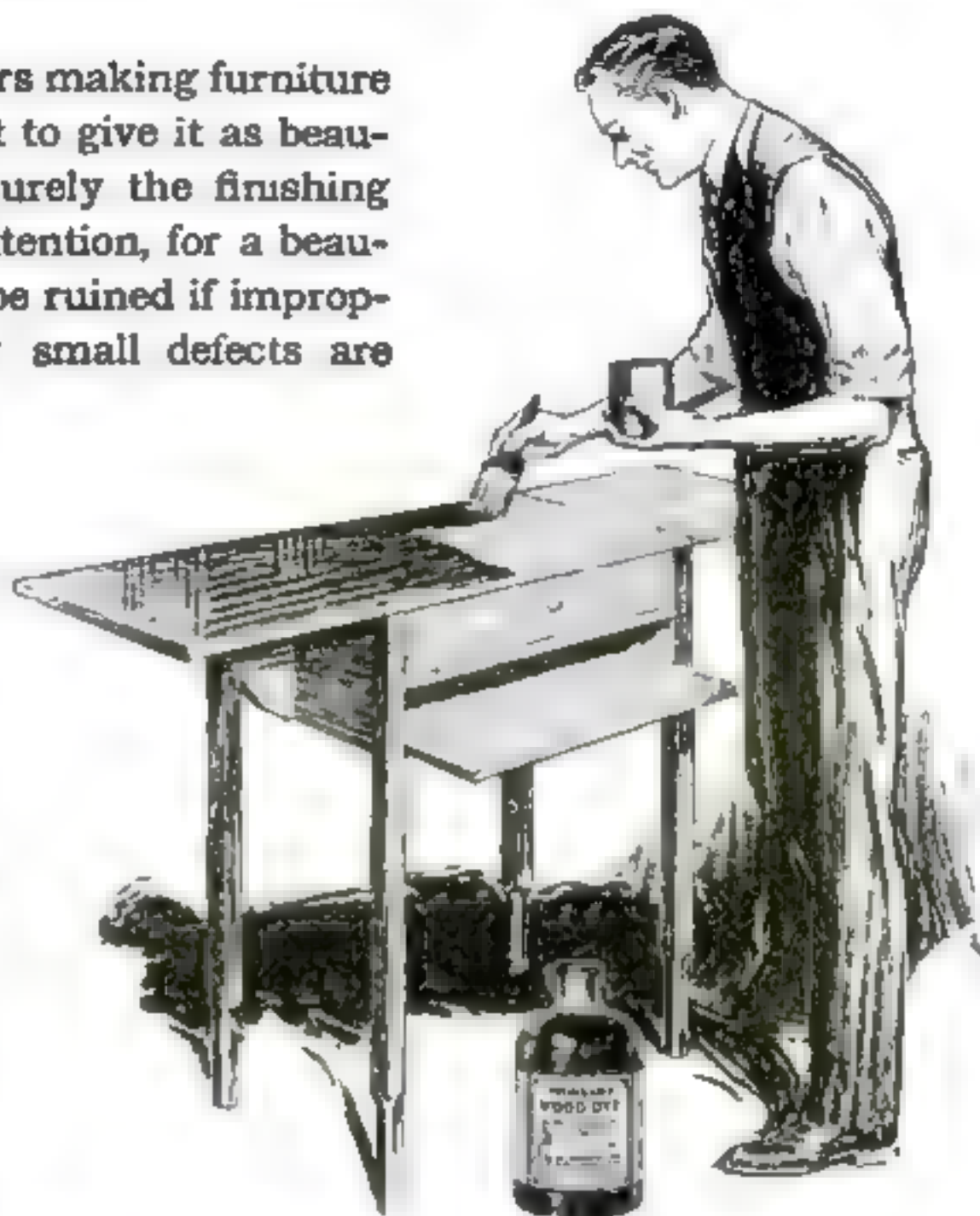
The rubber is more flexible than the leather, and sand will not get under it and collect on it. While this is a simple repair, it is surprising how well it works. Our pump gave us trouble for years at various times, but this repair ended the difficulty.—CLYDE BRINDEL.



# How to Give Home-Made Furniture that Finished "Professional" Look

After spending precious hours making furniture by hand, you naturally want to give it as beautiful a finish as possible. Surely the finishing should receive its share of attention, for a beautiful piece of furniture may be ruined if improperly finished, whereas any small defects are minimized if well finished.

The Johnson Book on Wood Finishing gives complete instructions for finishing new and re-finishing old wood—soft or hard. It tells how to stain wood artistically—how to remove old paint and varnish—how to secure a beautiful enamel finish, etc. This book is the work of experts—profusely illustrated in color. It includes color charts—gives covering capacities, etc. It is full of valuable, authoritative information on Artistic Wood Finishing. The coupon below tells how to get a **FREE** copy of this authoritative manual on a fascinating subject.



## JOHNSON'S WOOD DYE

Johnson's Wood Dye is for the artistic coloring of all wood. It is very easy to apply—dries in four hours and will not rub off or smudge—penetrates deeply, bringing out the beauty of the grain.

Johnson's Wood Dye is a dye in every sense of the word. It contains no finish whatsoever. Like most first class products it answers one purpose only—it dyes the wood. A finish must be applied over it—we recommend Johnson's Varnishes or Johnson's Polishing Wax.

Johnson's Wood Dye is made in seventeen beautiful shades, among the most popular of which are:

- |                    |                |
|--------------------|----------------|
| 123—Dark Oak       | 131—Walnut     |
| 129—Dark Mahogany  | 126—Light Oak  |
| 127—Brown Mahogany | 124—Golden Oak |

All shades may be easily lightened, darkened or intermixed. Full directions on every label. Select the shade of Johnson's Wood Dye that you want and order it from your dealer by name and number.

### FREE—25c BOOK ON WOOD FINISHING



Ask for a **FREE** copy of the Johnson 25c Book on Wood Finishing at stores displaying the sign shown at right. These stores carry Johnson's Artistic Wood Finishes and will be glad to show you wood samples—and answer questions on how to properly finish wood. If no store in your locality can supply the Johnson Book—mail this coupon for a copy Free and Postpaid.

YOUR DEALER'S NAME . . .

Your Name . . .

Your Address . . .

City and State . . .

S. C. JOHNSON & SON, Dept. P.S.4, RACINE, WIS.





# Stepping-Stones for Garden Walks

How you can build picturesque pathways about your home

**S**TEPPING-STONES made of concrete are much less expensive and much easier for the home-owner to make than a solid sidewalk. In addition, they have the advantage of a more artistic appearance for garden pathways or walks between house and garage. The fact that so many architects now specify stepping-stone walks in connection with designs for costly residences is an indication of their decorative value and growing popularity.

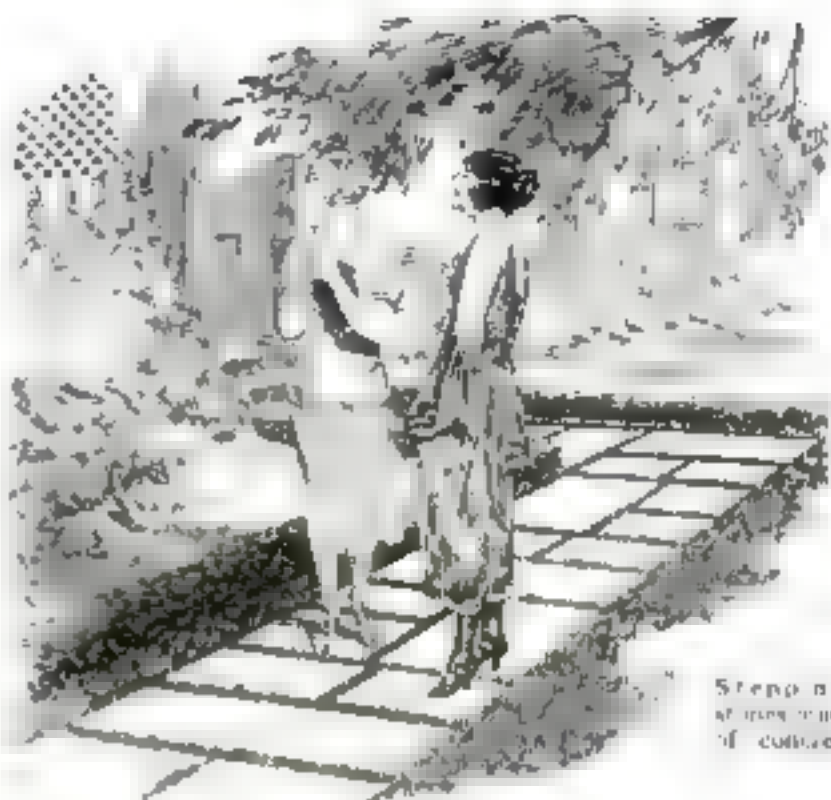
Frost will not injure this kind of a walk, for if the individual stones are lifted in the winter, they will settle back in place when spring comes.

Slabs of several sizes make a more attractive walk than if only one size is used. In the walk illustrated a pleasing pattern has been obtained with only three different sizes of slabs. The sizes

used are: 9 by 9 in., 9 by 11 in., and 11 by 22 in. These three sizes can be arranged in a large variety of combinations, with about 2 in. of sod between them.

One form for each size is sufficient to produce a considerable length of walk in the course of a few days, but if more speed is desired, two or more of each may be used.

The forms are made from pine lumber about 3 in. wide, nailed to any sort of boards, or simply nailed together and laid on smooth ground. If the forms are laid on the ground, care must be taken to



Stepping-stones made of concrete

keep the framework down by driving pegs into the earth and nailing the wood to them.

The mixture to be used for the lower part of the slabs can be one part of cement to four parts of coarse, clean gravel. Remember to mix the gravel and the cement thoroughly before adding water, and add the water in small amounts, being careful not to produce too wet a mixture.

Now oil the forms and fill them to within  $\frac{3}{4}$  or  $\frac{1}{2}$  in. of the edge with the mixture. "Tamp" it down solid and run a trowel around the edges to force the larger pieces of gravel away from the boards.

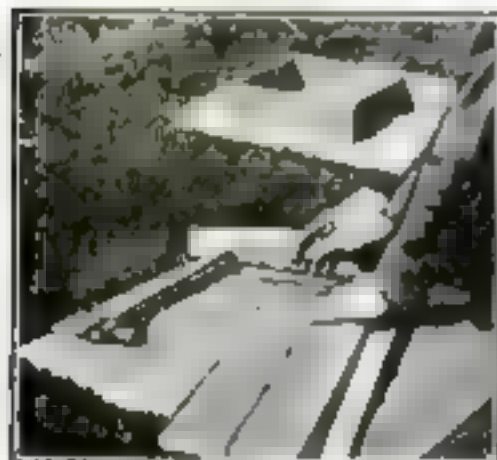
The work is now ready for the finishing coat, which is made up of two parts fine sand and one part cement. This mixture may be colored to suit the maker's taste and design by the use of Venetian red, burned umber, yellow ochre, or almost any other inexpensive color, in powdered form. This color should be mixed dry with the cement and sand before water is added. Too much color will weaken the cement.

When the surface has been smoothed with a wooden block, the sharp edges around the form can be rounded with a sidewalk edger, with a small trowel, or, in fact, with a homemade wooden tool.

The slabs are left for one or two days until the mixture "sets." They must be protected from the sun during this process and should be kept moist, particularly if the weather is hot. The forms are used again and again until a sufficient number of stones is made.

When enough slabs have been made for the walk, a sketch should be made showing the best arrangement of their positions. The simplest way to lay them is to excavate as for a continuous walk of the same width and, after the slabs are laid, put pieces of sod between the blocks.

More irregularly shaped stepping-stones can be made without forms simply by excavating holes in the ground and filling them with concrete.



Marking length of form members which are made of 3-in.-wide strips



In nailing the forms together let nails project so they can be pulled out easily when the concrete is hard



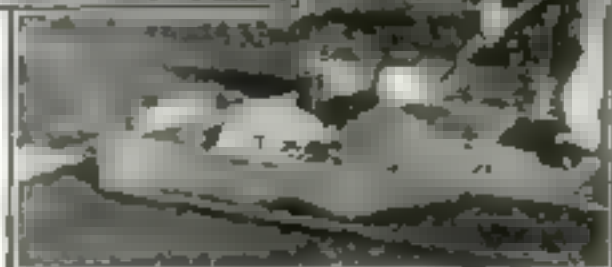
Square the forms and nail them to a baseboard



Oil the forms lightly with kerosene or oil to prevent cement from sticking. A weathered plank or board may be used for this purpose if desired



Mix the cement and gravel thoroughly before adding water; then wet the mixture and turn it over and over until uniform consistency. This mixing-board is the back piece of a piano box



The correct consistency of the mixture is shown above. As it is slightly more fluid, after the formwork is filled, the surface is smoothed with a wooden block as at the left. A very smooth surface is not desirable as it does not do too much troweling





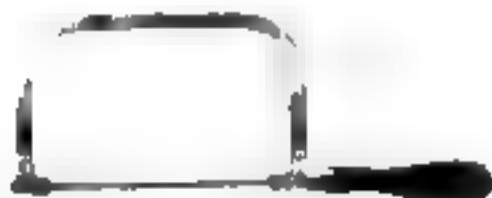
# To the million young men who are buying their first saws



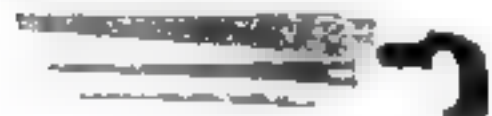
Whatever work you have to  
do, there is a Disston  
Saw to do it



Disston Buck Saw, No. 4—For accurate  
cutting of rafters, fine joints or stock of  
wholesalers.



Disston Coping Saw, No. 10—For cutting  
scroll work, ornamental wood work, toys,  
etc. Tension of blade adjustable to each  
job.



Disston Nest of Saws, No. 3—Ten-inch  
key-hole saw, 14-inch compass saw, and  
16-inch utility or pruning saw with  
adjustable handle.

**Y**OUR first saw! When you  
choose it, you are setting  
a standard for the work you  
have to do in all the years  
to come.

You need not be an expert  
when you go to buy your saw,  
for the carpenter has chosen  
for you

The Disston Saw, every-  
where, is "The Saw Most  
Carpenters Use"

The Disston Hand Saw cuts  
true to the line. It is true itself  
—smithed and tensioned on the  
anvil by a master of the craft.

It cuts fast without bind-  
ing because it is ground right  
for clearance. Only a Disston  
craftsman can taper a saw  
blade to work like that.

It seems "alive" when you  
use it, so easy is its balance.  
Only a Disston expert can  
give a saw such balance.

And your Disston Saw will  
hold its edge: Disston makes  
the steel and gives it the  
Disston temper!

Disston Saws, of Disston

Steel, are the most widely  
used saws in the world. Me-  
chanics everywhere have  
learned what the name Disston  
on a saw means to them.

"After 35 years' use, my four Disston  
Saws are good for another 10 or 20 years.  
Some saws! The good old Disston—an  
honest saw for honest work."

—John J. Harris, Heathboro, Vt.

"I am still using a Disston Saw that was  
my father's before me. It has been in use  
65 years and is still good. I have used  
Disston Saws for 36 years."

—J. E. Harrison, Atlanta, Ga.

"I wouldn't lay down my Disston for any  
other saw on earth, and I have been using  
them for more than forty years."

—L. L. Loftis, Prior, Utah.

You will find the Disston  
Hand Saw at the nearest  
hardware store.

Take it in your hand. Try  
its spring, its easy thrust and  
balance. Then make that saw  
your own!

## Ask Disston!

Tell us what kind of work you  
are doing, in wood, metal, stone,  
ivory, rubber, leather, cloth, fibre  
or other material, and we will tell  
you what types of saws to use.  
Disston issues many books to aid  
the users of saws and tools.

Henry Disston & Sons, Inc.  
Philadelphia

Hardware dealers the world around sell Disston Saws, Tools, and Files

# DISSTON



# Better Shop Methods

*How Expert Mechanics Save Time and Labor*



## Cabinet Keeps Lathe Tools Handy

By Edward Kilburn

*Machine-Shop Superintendent*

**N**OTHING is more conducive to fast and accurate work than having the proper tools within easy reach. This is especially true in respect to lathe work, which plays such an important part in every machine-shop output.

"A place for everything and everything in its place is, indeed, a maxim particularly applicable to the machine shop. The great number of small tools and appliances cannot be used to best advantage if they are not handy."

The accompanying illustrations show how to provide facilities for properly taking care of all the small tools and accessories used in connection with lathe work. The rack is particularly useful where it often is necessary to remove the toolboard (if one is used) when doing long length work on the lathe.

The tool cabinet is supported by a frame made of pipe, angles and flat bar, and is fastened together by welding. The stationary portion of the frame is fastened to the back of the lathe bed near the tailstock end. The other part is arranged to swing upon the stationary portion and carries at its upper

end a cabinet with suitable drawers for cutters and other small parts. The lower flat or table portion of the cabinet is used for lathe tools, the upper board to hold lathe centers, tailstock chuck, and the like.

the lower end of the frame to make its operation easy.

The mechanical diagram shows clearly the construction of the elevating device and bearing. It will be noticed that there is a central threaded rod. At its lower end this bears on a cross bar, which rests on the top of the ball bearing. The bar is located in a slot in the central hollow portion of the swinging frame. Screwing the nut A at the top of the bar against the upper flat bar B raises the frame and with it the cabinet. Releasing the nut lowers the cabinet.

The nut A has a flange or enlarged lower portion, which bears upward against the bar B.

The main or upper part of the nut, which passes through B, is fitted with a handle.

This device is much more convenient than a stationary cabinet, which must be removed to the floor when long work is placed in the lathe. As soon as it is on the floor, a cabinet becomes nothing more than a stumbling block for every passer-by, and the chances of tools being lost or damaged are greatly increased.

### Spring Threading Tool

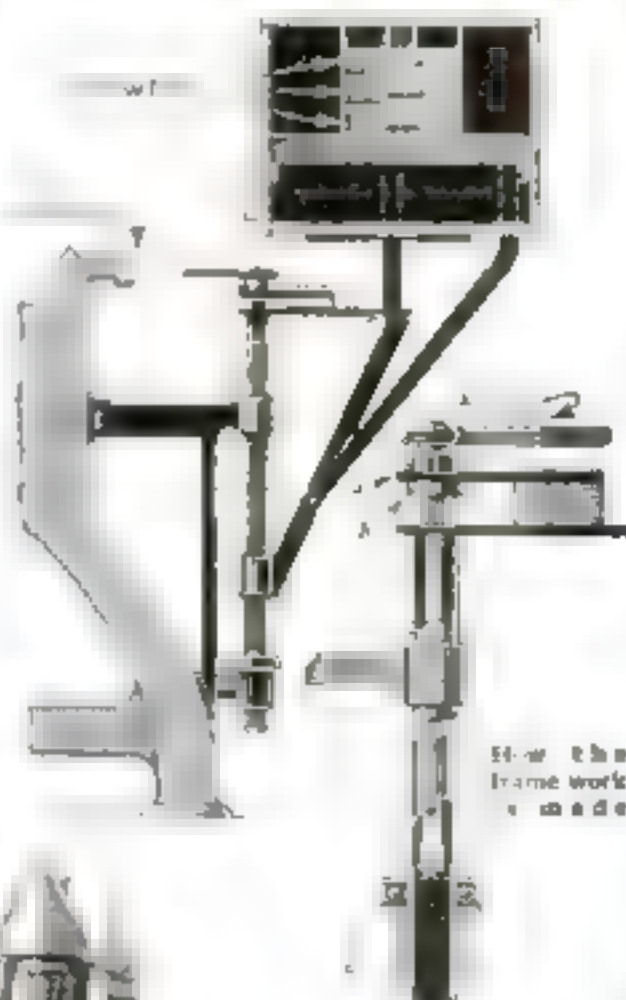
**T**O OVERCOME the shortcomings of certain commercial spring threading tools, which have no provision to prevent them from springing sideways or parallel



with the axis of the work. The tool is made of tool steel and is hardened. It is provided with a spring bushing, which is directly beneath the spring bushing. This is keyed and screwed to the shank, A, and has a slot in its top edge that engages a keylike extension or lug, C.

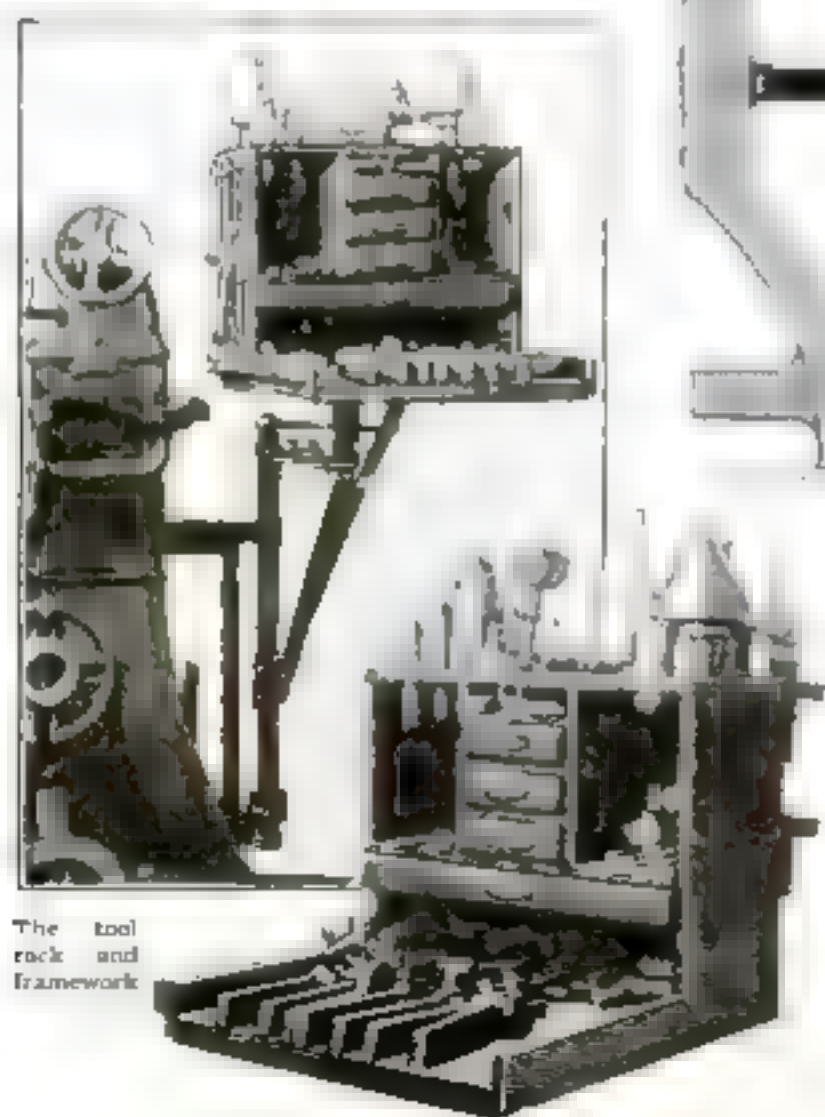
Bushings are inserted as desired, to increase or decrease the spring of the tool — CHARLES KUGLER, Philadelphia, Pa.

**D**ON'T fail to turn to pages 126-134, where you will find the continuation of the Better Shop Methods Department.



How the frame work is made

The mechanism of the device is so arranged that when the cabinet is in position, it is lowered to rest firmly on the bed. When it is desired to remove the cabinet from the bed, the cabinet is raised and swung around out of the way. A ball bearing is provided at



The tool rack and framework





**Starrett**

*Why do the  
Crack Machinists  
Advise  
the Apprentice  
to start with  
Starrett Tools*



## Apprentice Set No. 901

You'll use the Starrett Tools you buy today for the rest of your life. Ten years seems like a reasonable length of service for a Precision Tool, yet any veteran machinist will show you Starrett Tools which he has used twice and three times ten years. It's all in the way Starrett Tools are made. Parts are correctly proportioned. The finest steel the market affords goes into

these lifetime tools. The workmanship is unexcelled—a characteristic which is obvious when you examine a Starrett Tool—and is always evident in its lasting accuracy.

Starrett Apprentice Sets (Nos. 900 and 901) give you the tools you need to start and tools you'll always need. Sold by first-class hardware stores everywhere at a price you can afford to pay.

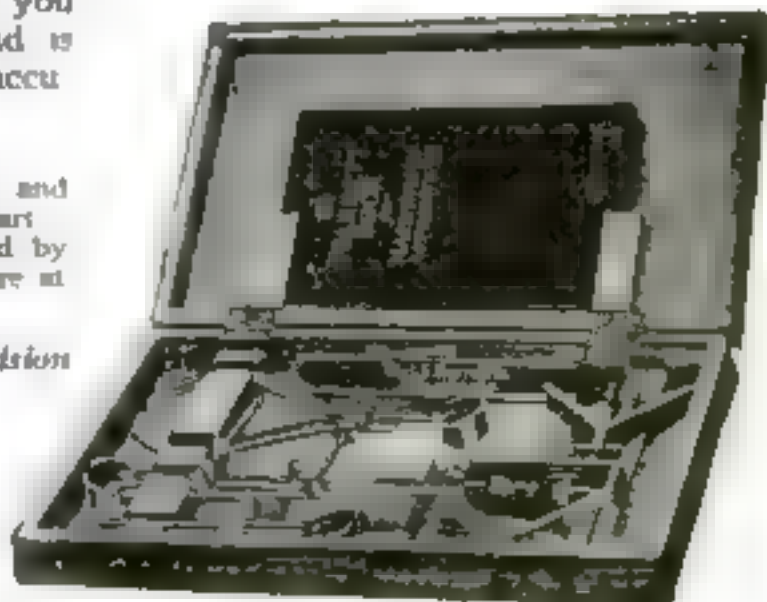
Write for Starrett Catalog No. 23 "W" describing the uses of 2200 Fine Precision Tools FREE.

### THE L. S. STARRETT CO.

World's Greatest Toolmakers

Manufacturers of Hacksaws Unexcelled  
Starrett Tapes—Standard for Accuracy

ATHOL, Mass.



The Starrett Set for Apprentices and Students comprises the following Precision Tools neatly cased in a substantial and nicely finished wood tool box: 6-inch Combination Square No. 11 complete, 6-inch Flexible Steel Rule in Pocket Case No. 320, Center Punch No. 117-B, Center Gage No. 390, 5-inch Divider with Spring Nut No. 77, 6-inch Outside Caliper with Solid Nut No. 79, 6-inch Inside Caliper with Solid Nut No. 73. And the Starrett Book for Machinists' Apprentices (Vol. 1), 184 pages that show "how to do it."





## Look for "D. MAYDOLE" on the head

IT'S definite assurance that the hammer with the looks and perfect "hang" has in addition a quality and toughness that makes it good for years of hard service.

Most experienced tool users can tell a Maydole Hammer even without looking at the name. It has a distinctive character that has been developed and enhanced throughout the 82 years devoted by its makers to perfecting the hammer. Pick up a Maydole and you'll find it has a "hang" unlike any other hammer—most carpenters, machinists and other mechanics like it better.

Ask your hardware dealer to show you a carpenter's, machinist's or other type of Maydole Hammer. You'll see the difference.

Write for useful pocket handbook 23 "B." It's free.

# Maydole Hammers



The David Maydole Hammer Co.  
Norwich, New York

7050

## The Home Workshop

### How to Plane a Board Accurately

Expert Shows You His Own Methods

By Emanuel E. Ericson, *Noted Manual Training Authority*



Surface planing with strokes made the whole length of the board, if possible (above). If board is wide, "cross plane" it first, then start at one edge, letting each shaving partly overlap the previous one until the whole surface is covered. Repeat, working back to the first edge.



Testing the surface with edge of plane against the light (above). Also test from corner to corner to detect twist or "wind." If board is large, this is done on the bench, using a straight edge, if plane is not long enough.



Planing end (at left) after one broad surface and one long edge have been planed. The long planed edge is toward the worker. Note that one corner is chiseled off to prevent wood from splitting.



Testing with square (at left). The end must be tested both from the broad surface and the long edge. Hold square firmly against corner and let square lean slowly. The last plane stroke must be right across.



Marking to length (at right). Lay rule on surface, locate knife at correct point, then move square up against knife. For accurate work draw lines all around the board.



Gaging for thickness (above). Hold the gage firmly against the wood and tilt bar forward. Mark both ends and edges. When planing put rough end against the bench stop.



Sawing board 1/16 in. beyond knife line to allow for truing the end with the plane by the method previously used.



Marking to width when a board is too wide for the gage. When the edge is planed, the chiseled corners disappear.





UPSON  
BOARD

IN THE attractive living room above Upson Board has permanently renewed shabby walls and ceilings.

And aside from its use for walls and ceilings Upson Board has 100 uses around the home. Its easy workability makes it ideal for making wardrobes, photographic dark rooms, cabinets, doll houses, wastebaskets, lapboards, tables, toys and countless other useful articles.

It will pay you to keep a few panels in your home workshop. Mail the coupon for samples and details!

THE UPSON COMPANY  
427 Upson Point, Lockport, N. Y.

☐ Check here and mail with 5c if you want Upson samples and literature.

☐ Check here and enclose 25c if you want blue print. What kind of room? \_\_\_\_\_  
New or remodeling? \_\_\_\_\_

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

# At last - a wall that successfully resists heat-cold jars-moisture-time

IN NINE out of ten homes, investigation shows at least one cracked, shabby plaster wall or ceiling!

Now there is a sure, quick, easy way to transform such a room. Upsonize! Apply big, sturdy panels of Upson Board right over the old plaster—in new construction, direct to studs. Then, appropriate wood trim, a coat or two of paint—and your room is finished.

Upson Self Clutching Fasteners, a patented and exclusive Upson innovation, eliminate ugly nail marks—the big objection to ordinary wallboards—by anchoring Upson Board securely from the back.

## The nearest-perfect wall material!

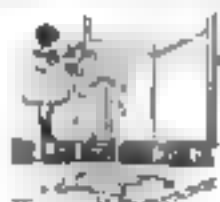
Conclusive tests have proved the superiority of Upson Board. In one of many dramatic tests for strength, made by impartial engineering laboratories,



weights were dropped from several heights upon specimens of different wall materials. Upson Board withstood an impact of 40 to 70, more than the other fibre wallboards tested, and nearly 150, more than plaster-filled boards twice as thick. Jars and blows that

would ruin ordinary plaster walls have little or no effect on Upson Board.

In another impressive test, Upson Board immersed in water for a given length of time gained only 1 1/2 ounces to the square foot. Gypsum-filled board exposed to the same test increased nearly 1/2 pound to the square foot. Other wallboards were found to absorb nearly twice as much water as Upson Board. The ordinary leak has little or no effect on Upson Board.



## A wonderful new plan service!

Ask your lumber dealer to see the amazing new Upson Blue Book—the most complete plan service ever offered for renewing and beautifying walls and ceilings. If he hasn't it, send us his name and 25c, and we will mail you full-size blue print with complete directions for Upsonizing any room. (State kind of room and whether new construction or remodeling.)



THE UPSON COMPANY  
427 Upson Point, Lockport, N. Y.

# UPSON PROCESSED BOARD

Genuine Upson Board has the famous Ring Center



# The Wheel's the thing

**THE** new Millers Falls glass cutter wheels cut as steel wheels never cut before. They are hard, sharp, uniform; the edges last. They are right. We've been making glass cutters for 45 years. With all that experience, we put in more than a year of intensive planning to develop our improved wheels. The wheel has always been the weak spot. We tried many steel alloys, different heat treatments. Each new lot of wheels was tested rigorously. Now we say they're right, because we have proved it to ourselves. The Millers Falls name on them proves our confidence to you.

**This is No. 7 Improved—**  
single wheel, easy grip handle, enameled steel.

**This is No. 300 Improved—**  
the perfect wheels in rubber finish with frame. Wheels protected from injury by patented feature of cutting about integral with turner. Easy grip handle, enameled hardwood.

**Millers Falls Improved Glass Cutters** with the new long-life, fine-cutting wheels. Special alloy steel wheels, hardened by special process; uniform; lasting. They make a deep, clean cut. Eight styles.

**MILLERS FALLS COMPANY**  
Millers Falls, Mass.

28 Warren St. New York 9 So. Clinton St. Chicago

Manufacturers of Mechanics' Tools, Hand Saws and Automobile Tools

**MILLERS FALLS TOOLS**

## Ingenious New Bunny Toys Made Entirely of Wood

By Charles M. Miller

*Asst. Supervisor of Manual Training,  
Los Angeles City Schools*

**M**ANY methods of building new and interesting rabbit toys are suggested in the accompanying illustrations. With slight modifications some of the mechanical movements could be used effectively on other animal forms.

The edges of toys cut with coping-saw, such as these rabbits, should be square. Whether they are filed or sand-papered, or both, the edges should not be rounded, as is often done.

The back legs, when movable, operate in unison. Usually they are connected below the body by means of a small dowel through both feet.

Among the many mechanical movements possible, that of the rabbit shown in the photograph is perhaps the simplest. The form is  $\frac{1}{2}$ -in. thick wood. The front wheels are glued to a  $\frac{1}{4}$ -in. dowel that passes through a  $\frac{5}{16}$ -in. hole in the front feet. Small button molds are slipped up close, but not too tightly, against the sides of the feet to prevent the axle from slipping from side to side. The rear axle is the same except that the wheels are larger, in this case 3 in. in diameter, and closer together. The rear wheels are fastened to the axle about  $\frac{1}{4}$  in. off center; this gives a jumping motion (Fig. 1).



proved by painting it with characteristic markings, some of which are suggested at the bottom of the page.

Four movements a little more complicated than the Peter Rabbit toy are shown in the drawings of Fig. 2. In the first one, the rabbit raises his front feet through the action of a cam on the



Fig. 1. Simple rabbit toys cut out with a coping-saw.

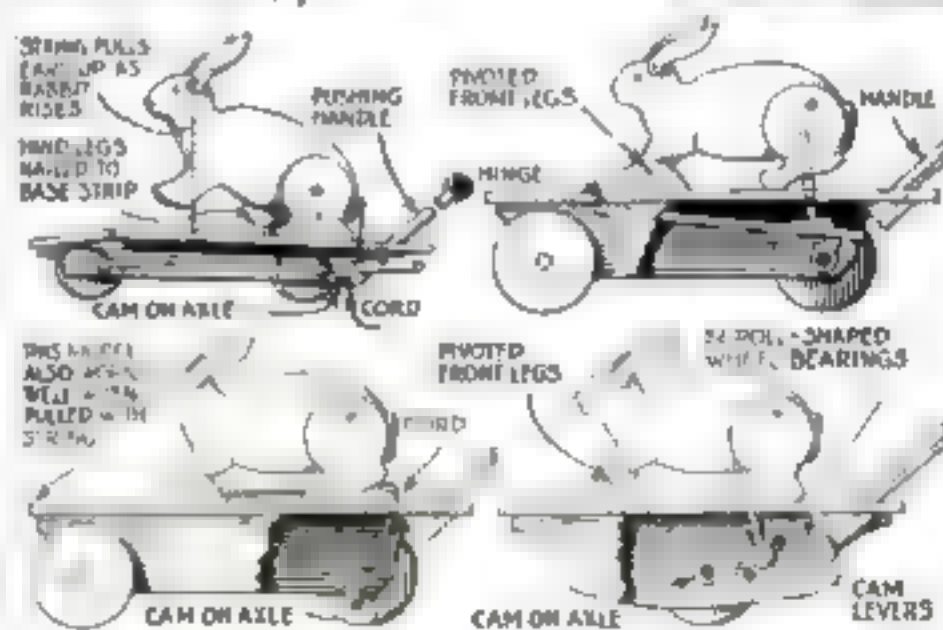


Fig. 2. Four methods of giving a toy bunny a lifelike hopping motion as it either is pushed by a handle or pulled along the sidewalk.

vent the axle from slipping from side to side. The rear axle is the same except that the wheels are larger, in this case 3 in. in diameter, and closer together. The rear wheels are fastened to the axle about  $\frac{1}{4}$  in. off center; this gives a jumping motion (Fig. 1).

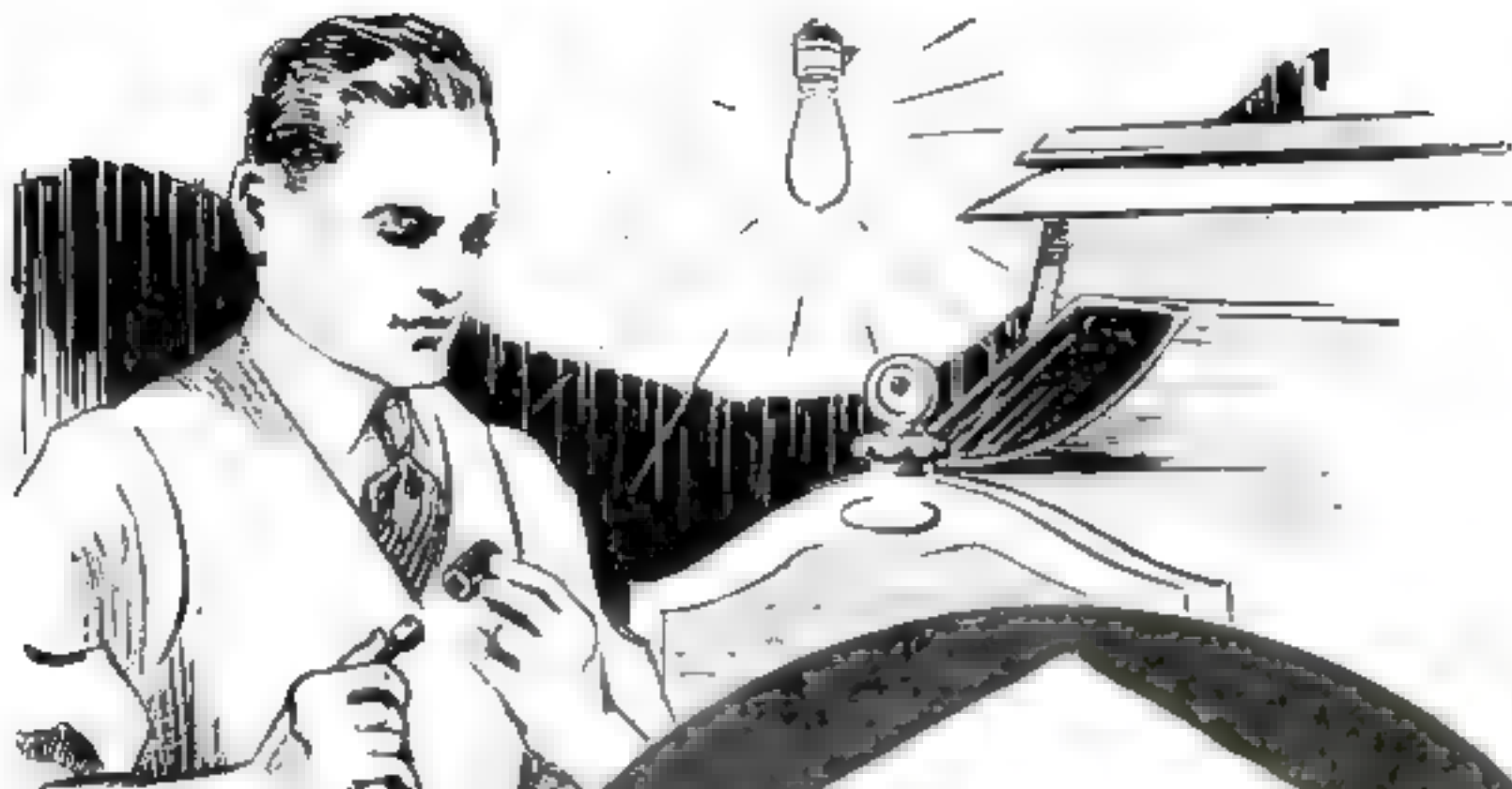
Peter Rabbit in this particular toy has a red coat with a black collar. The appearance of any rabbit toy can be im-

proved by painting it with characteristic markings, some of which are suggested at the bottom of the page. Four movements a little more complicated than the Peter Rabbit toy are shown in the drawings of Fig. 2. In the first one, the rabbit raises his front feet through the action of a cam on the rear axle, which pulls a string attached to the tail. At the same time another string, which runs from the base board up through the front of the body and the head to the ears, raises the ears at the end of the upward movement of the body.

Shown at the right of this is a method for making a bunny hop. A wooden cam glued on the rear axle moves up a hinged board that in turn pushes up the hind feet. A third method provides for raising the hind legs with a string and cam and pulling them back with a spring. This toy operates well when pulled; the others are more certain in their action when pushed. In the fourth example the cam's motion is transmitted through two levers mounted on a shaft.







## Save Your Knuckles

**G**O OVER every bolt and nut, from motor to rear end, with an ever-useful set of Blackhawk "Q D's." There's a socket to fit every job, without ever slipping off—and a handle to give you just the right reach and leverage.

Whatever make or model of car you drive, your dealer can supply you with a selected "Q D." set—especially designed by Blackhawk engineering for your particular car.

Extra husky handles with comfortable grips and sturdy broached sockets—exactly 1/64" oversize—tougher than any nut they will ever meet. You will like the rich, durable, all-black finish that's baked on.

See your dealer. Have him show how simple home repairing is with a Blackhawk "Q D." set. If he can't supply you, write us direct.

Made and Guaranteed by  
**AMERICAN GRINDER MFG. CO.**

Dept. L, Milwaukee, Wis.

(Also manufacturers of  
Blackhawk Water  
Pumps for Fords)

When you see a  
"Hex" think of  
BLACKHAWK!



# BLACKHAWK

## Welded Wrenches







**EVEREADY HOUR**  
EVERY TUESDAY AT 9 P. M.  
*(Eastern Standard Time)*

For real radio enjoyment tune in the  
Eveready Group—Broadcast through  
stations

|      |              |      |              |
|------|--------------|------|--------------|
| WEAF | New York     | WFI  | Indianapolis |
| WJAN | Philadelphia | WDAE | Charlotte    |
| WEEL | Buffalo      | WGR  | Buffalo      |

*Only a Buffalo  
Eveready  
Radio Battery  
can make your  
radio work  
so long!*

# Satisfaction Reliability Economy

You need three things in radio "B" Batteries—satisfaction, reliability and economy. You get them all in Eveready "B" Batteries. Satisfaction, because they produce all the current needed by your tubes, giving you the maximum results of which your set is capable. Reliability, because you can depend on them to work at full power. Economy, because they long maintain their strength, and because they are low in price.

Advances in the art of battery manufacture make Evereadys last longer than ever. You actually get much longer service for your money.

There is an Eveready Radio Battery for every radio use.

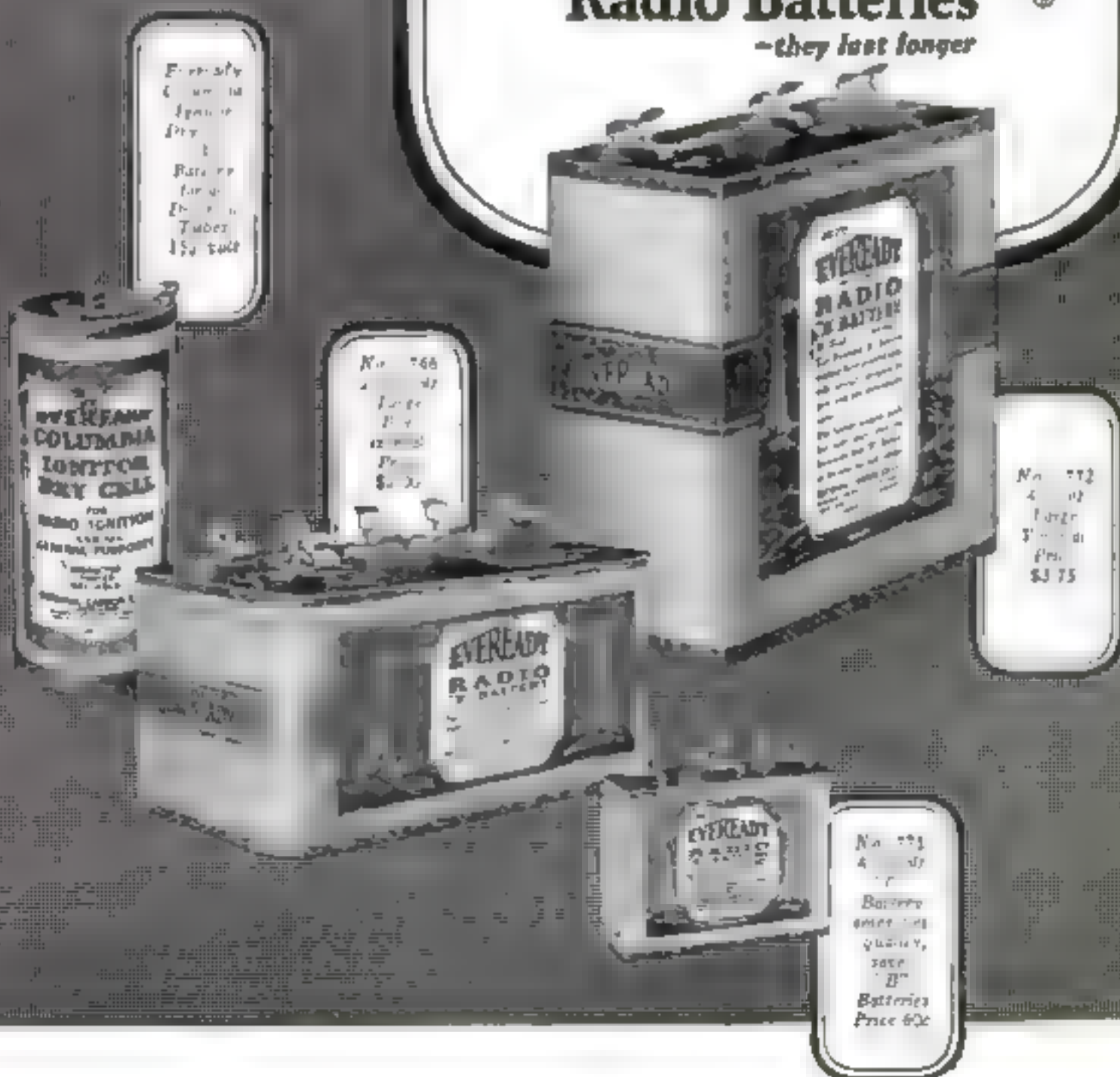
Buy Eveready Batteries.

*Manufactured and guaranteed by*

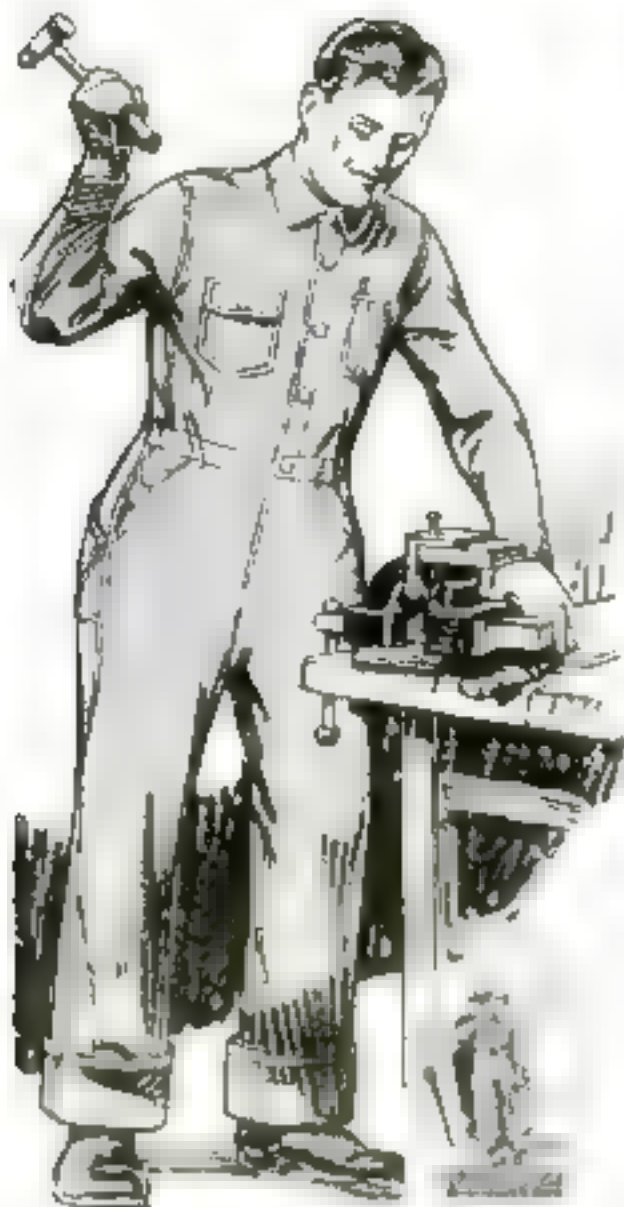
**NATIONAL CARBON COMPANY, INC.**  
New York San Francisco  
Canadian National Carbon Co., Limited, Toronto, Ontario

## EVEREADY Radio Batteries

*—they last longer*







## A Necessary "Tool" For Your Workshop

FOR the man or boy who has a home workshop, Lee Union-Alls are a handy "tool" to have about. All that is necessary when you want to get busy is to slip into them and start your work. They cover the body from head to foot and can be worn over other clothing. They save clothes, also. And they save time where the hours for such work are limited.

Wear Lee Union-Alls, the original one-piece work suit, worn by thousands of mechanics, shopmen, garage workers and industrial workers. Lee Union-Alls are quality-built—close-woven cotton fabric, riveted rustproof buttons, reinforced strain points—fully guaranteed to give satisfaction. They give solid comfort, long wear, and are neat in appearance. Accept no substitute—look for Lee on the buttons. Thousands of live dealers sell Lee Union-Alls. Ask your dealer today!

## Lee Union-Alls

THE E. D. LEE MERCANTILE CO.  
Kansas City, Mo.

Trenton, N. J.  
Minneapolis, Minn.

South Bend, Ind.  
San Francisco, Cal.



Lee Overalls and Work Shirts are other items in the famous Lee line. They are quality-built, also.

# The Home Workshop

## How to Re-Cane Your Old Chairs

The use of machine-woven cane—Steps in weaving the strands by hand

IN YOUR attic or basement there are probably one or more chairs that have been discarded because the casing of bottom or back has been broken. To put chairs like this into use again is not nearly the difficult task that you might imagine. You can repair such chairs and at the same time spend some pleasant hours in your own workshop, or even in the kitchen.

If the chair originally had machine-woven cane, you will notice that all the edges of the cane are held in place by a strip of reed or splines embedded flush in a groove. If the chair is round, first locate the end of this reed. Force a narrow chisel or a small sharp screwdriver between the ends of the spline and start lifting it out of its groove. Place a small flat block as a fulcrum between the chisel and the chair rail or frame and gradually pry up the spline. Square seats usually have four splines mitered at the corners. Clean out the groove with the chisel followed by a little hot water applied with an old toothbrush.

IF THE chair needs refinishing, attend to it now. At least the chair should be washed thoroughly with soap and water to which has been added a little ammonia. Machine woven cane from 10 to 18 in. wide may be purchased by the lineal foot at almost any upholsterer's supply house, and some local furniture dealers carry it in stock. Your piece should be about 2 or 3 in. larger all the way around than the opening in the chair. Both the open and the closed mesh, or matting, may be bought at about the same price.

If you have broken or split the reed spline while removing it from its groove, buy a new one. The size is standard and it comes in lengths of from 8 to 12 ft. Cut off a piece several inches longer than the total length required for your chair

By William T. Weld  
Shop Work Instructor,  
Central High School, Peoria, Ill.

and plane or scrape the sides of it until it makes a fairly tight fit in the groove.

Now make three or four wooden wedges for holding the cane in place temporarily. They should be from  $\frac{1}{4}$  to 2 in. wide, 6 in. long and tapering from  $\frac{3}{16}$  to  $\frac{1}{2}$  in. Hot cabinet glue is best for gluing in the spline, but a small can of first-class liquid glue placed in hot water until it is quite thin will serve nicely.

Now for the caning itself. Soak the cane in lukewarm water for two or three minutes to soften the fibers a little. Meanwhile pour or spread the glue in the groove and along its sides, using a thin, narrow stick or a small brush.

PLACE the moistened cane over the chair opening with the smooth or glossy side uppermost. Arrange the strands exactly parallel with the front and rear edges of the opening. Let the surplus material extend equally around all four sides.

Beginning at the back, drive in one wedge, forcing the cane down into the groove. Do the same at the center of the front rail, being careful to keep the strands of the cane parallel to the front and rear rails. Repeat at the sides.

With a larger wedge or a caulking iron drive the cane tightly into the groove all the way around. If there are any rounded corners, do these last with a narrow wedge. Your cane is now in place, but the outer edges stick up beyond the surface of the seat. Take a sharp chisel or a heavy knife and, working from the inside, cut off the surplus about  $\frac{1}{16}$  in. below the surface of the seat. Take great care not to injure the wood.

Some workmen prefer to drive the spline into place first and trim off the edges of the cane by cutting carefully against the spline just before it is driven in tightly flush with the seat rails.

Remove each wedge as you encounter

(Continued on page 117)



A seat that requires machine-woven cane

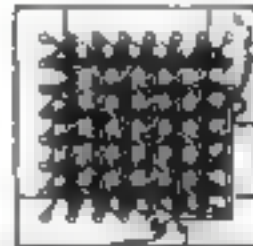
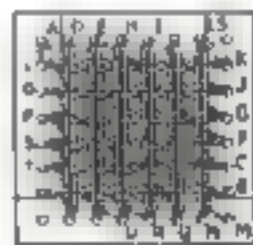
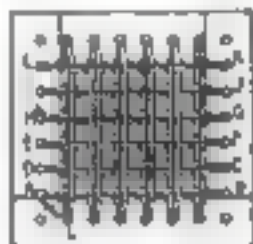
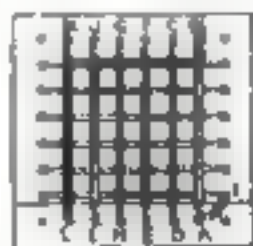
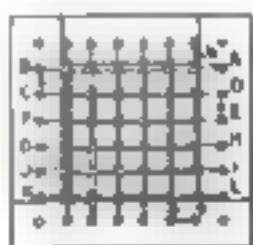
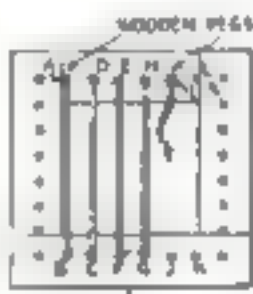


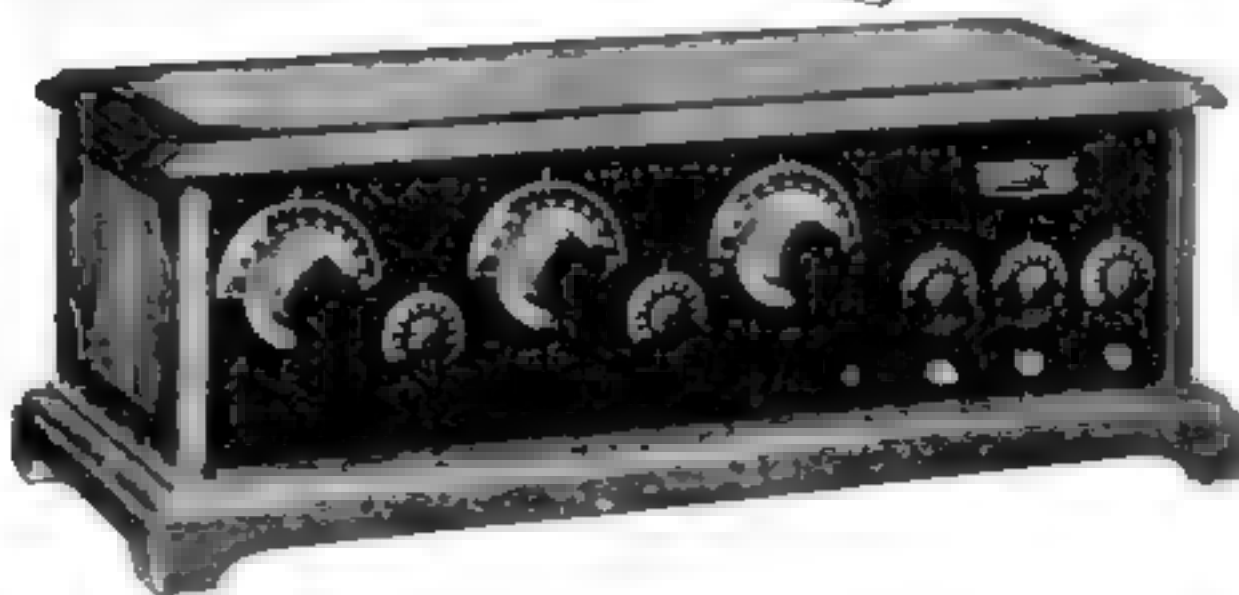
Diagram showing the simple steps by which a hand-woven chair seat is made



# LIBERTY



*Delivered  
Sealed*



"My wife said all radio sets sounded 'mechanical' until she heard the LIBERTY. That's why we bought one."



All five tubes are kept 'matched' because each tube is controlled by a separate rheostat. That gives pure tone.

*Owners of the LIBERTY Sealed Five are never without excellent entertainment.*



"A strong local station near us monopolized the air until we bought a LIBERTY Sealed Five."



LIBERTY is extremely selective. You need no verniers on these large dials.



## LIBERTY IS built for the Future

"I installed one of your Liberty Five radios in my home last week and the first three nights I operated this machine I pulled in the following stations:

|      |                    |      |                   |      |                |
|------|--------------------|------|-------------------|------|----------------|
| KFI  | Los Angeles        | WCAP | Washington        | WCBD | Evanston       |
| PWX  | Havana             | WCAR | Pittsburg         | KDKA | E. Pittsburg   |
| KHJ  | Los Angeles        | WJZ  | New York City     | WLW  | Cincinnati     |
| WBZ  | Springfield, Mass. | WMAQ | Chicago           | WBAI | Cincinnati     |
| WKAQ | San Juan, P. R.    | WOB  | Jefferson City    | WMH  | Cincinnati     |
| WFAA | Dallas             | WSB  | Atlanta           | WTAB | Evan. Ill.     |
| KYW  | Chicago            | WHB  | Kansas City       | WTAY | Oak Park, Ill. |
| WWJ  | Detroit            | WDAF | Kansas City       | WBBM | Chicago        |
| WCX  | Detroit            | WOR  | Newark, N. J.     | WQJ  | Chicago        |
| WOO  | Philadelphia       | WHAS | Louisville        | WLS  | Chicago        |
| WIP  | Philadelphia       | WTAM | Cleveland         | 2XHJ | New York City  |
| WEAF | New York City      | WJAX | Cleveland         | WREO | Lansing Mich.  |
| WOC  | Davenport          | WGY  | Schenectady       | WBLI | Havens Point   |
| WHAA | Iowa City          | WON  | Chicago           | 2XQ  | Willard, Tex.  |
| WBAP | Fort Worth         | WCAL | Northfield, Minn. |      |                |
| WRC  | Washington         | WHN  | New York          |      |                |

"I think the above test is remarkable inasmuch as I was not familiar with the operation of the set. Might also state that my residence is not located in a very desirable spot for reception but nevertheless the above stations were received in a very clear tone and with plenty of volume on the Loud Speaker."

"I wish you all the success you deserve with this wonderful set."

"Yours very truly,

Signed: M. E. Mogg, President,  
LINTON CONSOLIDATED  
COLLIERIES COMPANY,  
INDIANAPOLIS."

# \$100

less accessories for this 5-tube tuned Radio Frequency receiver in beautiful two-tone solid walnut cabinet.

## I-N-V-E-S-T in a LIBERTY Sealed Five

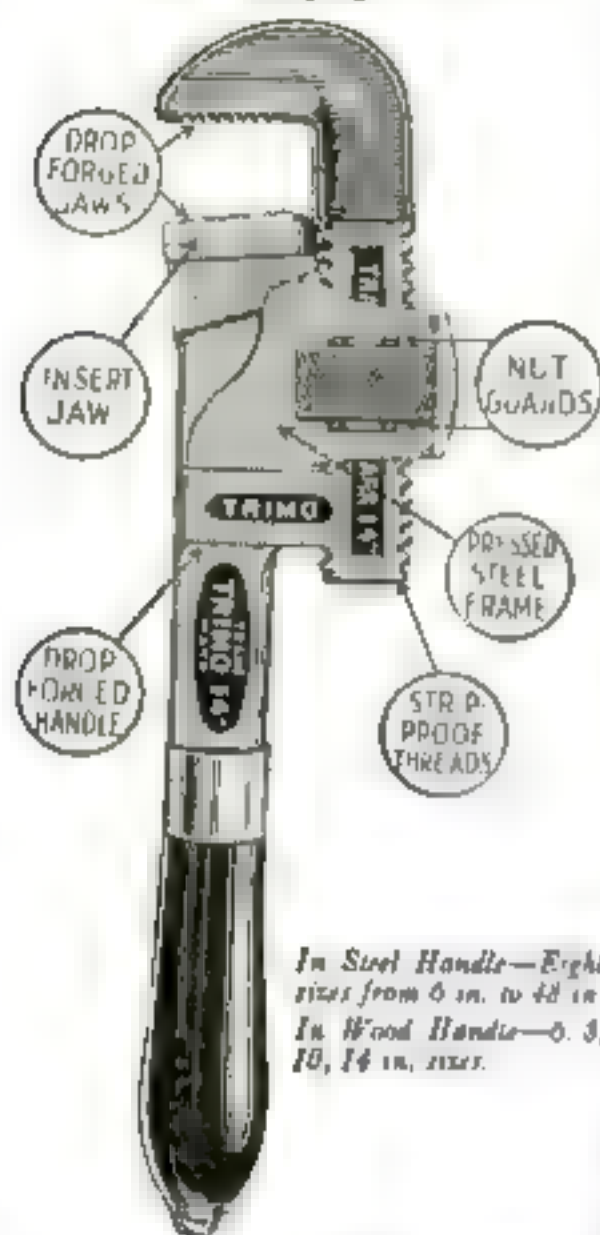
Manufactured by

# LIBERTY TRANSFORMER CO., INC.

555 NORTH PARKSIDE AVE., CHICAGO



# TRIMO



In Steel Handle—Eight sizes from 6 in. to 48 in.  
In Wood Handle—6, 8, 10, 14 in. sizes.

## A Big Time And Money Saver

HERE are the main reasons why most skilled mechanics, radio fans, householders and handy men demand the TRIMO PIPE WRENCH and will accept no other.

Having a rugged steel frame that WILL NOT BREAK, the brutal strength of the TRIMO guarantees your personal safety when hazardous or tough jobs have to be done.

You can make a TRIMO last for many years because its INSERT jaw in the handle can be renewed at small cost when worn. Handy NUT GUARDS that keep the wrench adjusted, make the TRIMO an ideal tool for working in close quarters.

At most hardware, plumbing and mill supply stores.

**TRIMONT MFG. CO.**

Roxbury, Mass.

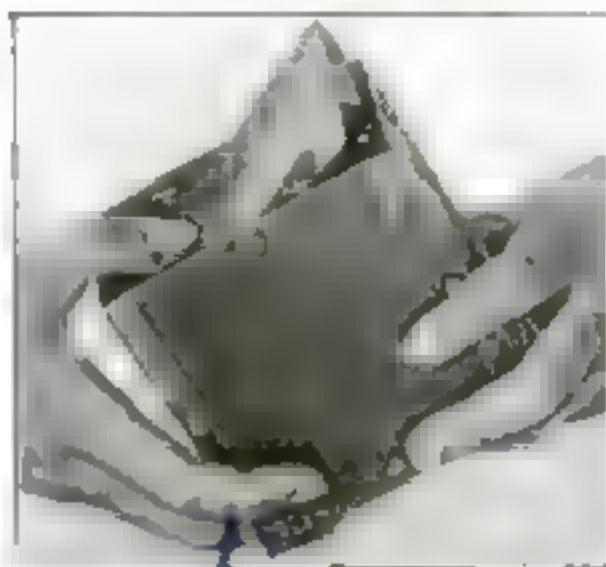
America's Leading Wrench Makers  
for nearly 40 years

## The Home Workshop

### How You Can Construct Easily a Trick Savings-Bank for Coins

By Kenneth B. Murray

MR. MURRAY, who is well known to readers of POPULAR SCIENCE MONTHLY for his articles on the construction of ingenious novelties, is an amateur magician of established reputation and an expert on sleight-of-hand illusions. His next article will tell how to make a palming device for cards.



bank is shown in Fig. 5. The secret of the trick bottom is revealed in Fig. 4, which shows how two of the bolts on the bottom are faked. Two of the bolts act as pivots on which the bottom can swing; they are real. The other two consist of the bolt heads only, soldered in place.

When the secretly hinged bottom of the

bank is closed, the short projecting ends of the fake bolts catch into corresponding notations in the bottom, or, better still, although not shown in the accompanying photographs, into holes the same as those for the real bolts. Being a tight fit, the bottom is held by the short bolts securely and it is necessary to exert considerable force with the thumb, as shown

in the upper illustration, to open the bank. A coin slot, of course, is made in the top.



Fig. 1. The parts need for making the bank.

It is practical to construct for the bank shown in the illustration. It can be made at small expense from steel and brass.

The parts necessary are shown in Fig. 1. The wide side pieces for the bank are 4 in. square, while the narrow side pieces and the bottom and top are 3 in. square, with flanges of 1/4 in. approximately 7, 16 in.



Fig. 4—The bank open.

firmly after each is fastened in place by hammering it as one would clench a rivet. It must not be possible to unscrew the nut from the bolt. The completed

Fig. 2. Fastening a side and an end piece with bolts.



Fig. 3. Putting the top in. Note how the bottom is pivoted on two bolts.

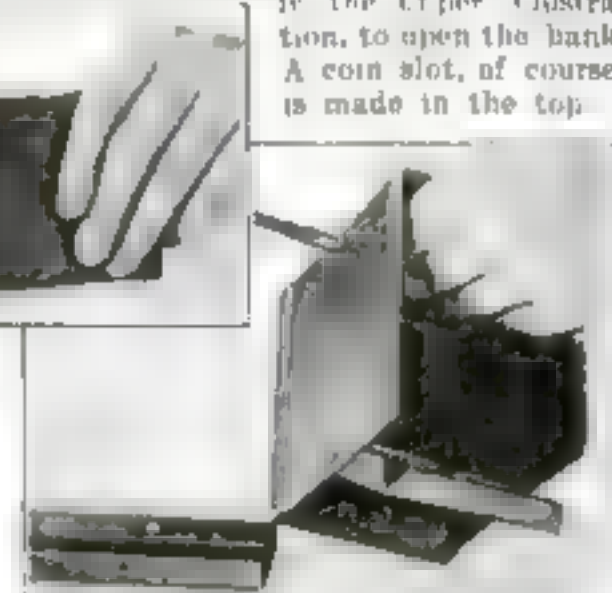


Fig. 5—Ready for use.

### Waxed Cloth Sometimes Is Useful as Glass Substitute

INSTEAD of glass for the windows of poultry houses, hotbeds, cold frames, and even storm doors, it is possible to use cheesecloth or other light weight white cloth treated with paraffin. The wax, shaved very fine with knife or block plane, is spread on the cloth and pressed into it with a warm but not hot electric iron.

It is important to use plenty of paraffin and to cover only a small section at a time.

The cost of the waxed cloth is about one-half that of ordinary glass. While the cloth does not admit the light like glass, it is transparent enough so that newspaper type can be read through it.

CLAUDE O. SOOTS, North Salem, Ind.

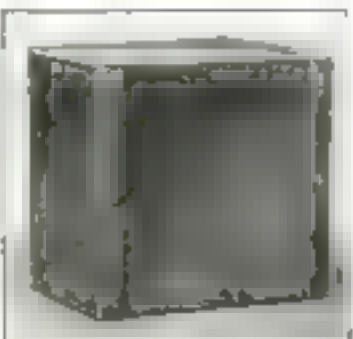


Fig. 5—Ready for use.



# Music Master Success



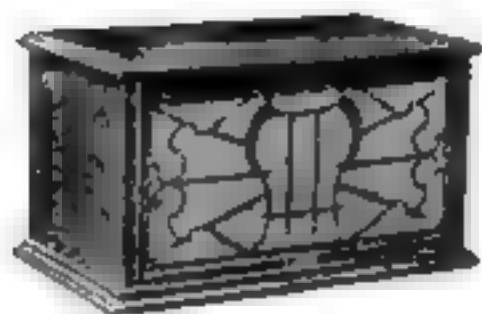
**Music Master**  
Resonant Wood Insures  
Natural Tone Quality

Model VI, 14" wood bell \$30  
Model VII, 21" wood bell \$35

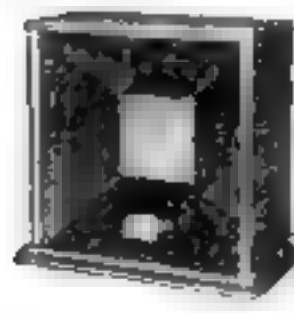
Connect Music Master in place of headphones. No batteries. No adjustments.

Prices of all models slightly higher in Canada

—Its True Significance



Model VIII. Mahogany Cabinet \$35  
with "full-flaring" wood horn



Model V, wood bell, Metal Cabinet, Mahogany finish \$18

THE advent of Music Master sounded the death knell of the mere "loud speaker." For it transformed the radio receiving set into a musical instrument—a triumph of re-creative art.

Two years ago Music Master's full voiced volume and characteristic tone qualities heralded the New Era of Radio Art. It made possible the re-creation of supreme Music, Song and Speech, in the wonderful stellar programme now an established feature of American nation-wide broadcasting.

Music Master does more than reproduce—it interprets, it re-creates—it transforms mere radio receiving into artistic enjoyment. Music Master has been imitated often, but without success. Music Master remains the unsurpassed musical instrument of radio—and there is no substitute.

## MUSIC MASTER—the Ultimate of Artistic Radio Re-Creation

Music Master's precision instrument is the acme of scientific perfection. Music Master's tone chamber of heavy cast aluminum is a marvelous mold of sound without distortion. Music Master's amplifying bell of resonant wood gives to every sound its full, vibrant qualities and natural and lifelike characteristics.

Music Master's manufacturers hold that every purchase of their product carries with it an implicit pledge of unreserved and unconditional protection. Back of your dealer's full and unfailing service stands the Music Master Corporation to guarantee its products direct, to anyone, anywhere, at any time.

## Music Master Corporation

Makers and Distributors of High-Grade Radio Apparatus  
Tenth and Cherry Streets

Chicago Philadelphia Pittsburgh  
Canadian Factory: Kitchener, Ontario





An awkward job made easy by the

## "YANKEE" Ratchet Tap Wrench

HE had to tap a thread in the transmission case for a magneto plug screw.

Without a "Yankee" Tap Wrench he would have been compelled to remove the coil box.

But the "Yankee" Tap Wrench made this unnecessary. He just pulled the sliding cross bar out to end position, where his hand could move freely; set the Ratchet Shifter, and tapped the hole quickly and easily.

Three adjustments. Right-hand Ratchet, Left-hand Ratchet and Rigid. Knurled finger turn at top quickly starts or backs out taps.

No. 259—Length 17 in. Chuck diam. 1/2 in. Holds up to 1/2 in. taps.

No. 261—Length 9 in. Chuck diam. 7/16 in. Holds up to 5/16 in. taps.

No. 1251—Length 11 in. For extra needing long reach. Otherwise same as No. 251.

## Some Other "YANKEE" Tools

Spiral Screw-drivers Quick-Return Spiral Ratchet Breast Drills Screw Drivers



Let us mail this Book to you FREE!

If you like tools you'll want this FREE "YANKEE" Tool Book

Shows every "Yankee" Tool, and tells you all about them. Write for your copy today.

"YANKEE" on the tool you buy means the utmost in quality, efficiency and durability. Dealers Everywhere Sell "Yankee" Tools.

NORTH BROOK MFG. CO., Philadelphia, U. S. A.

# "YANKEE" TOOLS

Make Better Mechanics



## Easily Made Cigar-Box Novelties

THE picture-frame and candlestick illustrated can be made at home more easily than almost any other piece of woodwork. It is not necessary to copy either design exactly; the method can be used with endless modifications and for ornamenting many objects, including boxes, bookends, stationery racks, inkstands, sewing trays, and the like.

The tools needed are few—a rule, a pocket-knife, and a piece of sandpaper, and, if available, a hand plane, a square, a coping-saw, and a file.

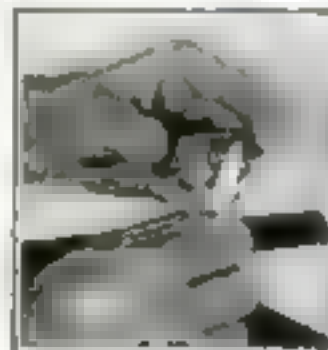
All the work is taken from cigar boxes. Boxes made of Spanish cedar, a red wood that looks like mahogany, will produce the best effect, but any kind of wood can be used and stained the desired shade. A combination of various colors



divisions must come out even. Cut the notches with a thin, sharp knife, making them even and square. The file or sandpaper is not used on them.

Mark the places for the blocks on the frame, heat the pieces slightly, if convenient, and glue them in place. Hot animal glue is quick-drying and satisfactory, but a good liquid glue will serve the purpose. Liquid glue is handy when heated.

When the glue on the surface of the frame is dry, make the strips to hold the glass and the picture in place on the back, and glue them. A few fine brads may be driven from the back to add strength, but do not drive them until the glue holding the blocks is absolutely dry. Then glue on the back piece



if you have a planer, use it to smooth the surface.

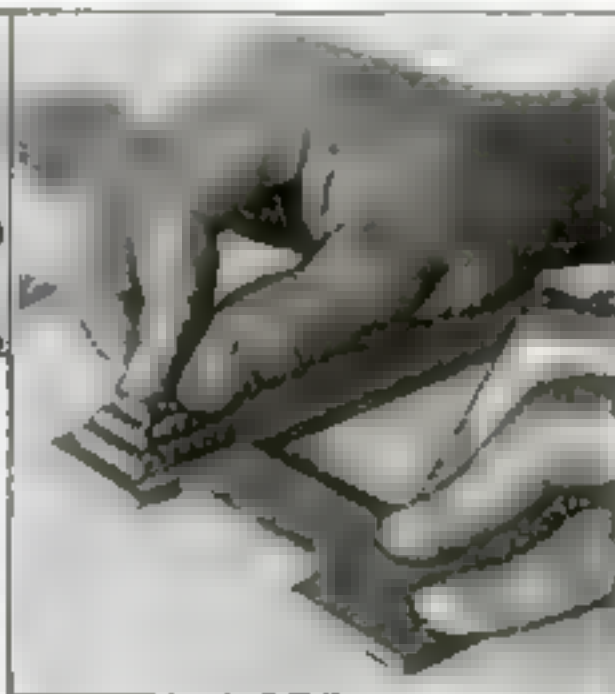
Next, a good cigar box is taken apart carefully, scraps of the paper are cleaned with sandpaper, and on a small block.

Lay out the frame (or whatever part is to be made) and use a knife to cut the outline deep into the wood. Cut a hole in the waste material to allow a coping-saw blade to be inserted; then cut out the center rectangle. If a coping-saw is not at hand, cut deeply with the knife from both sides until the wood is removed. Make the cuts on the outside edges with saw and knife, or with the knife alone. Smooth up the inside and outside edges with a wood file or sandpaper.

Make the square and rectangular blocks used to build up the surface as indicated.



Sawing out the picture opening



Notching blocks (at left) gluing them in place and placing a thin strip (at right)



proper. The glass and picture space is left open at the top so that the picture may be changed at any time. The frame may be made either to hang on the wall or to stand on a table or a dresser.

Apply a coat of mahogany stain and one or two coats of thin shellac or varnish.

In making the candlestick, the upright piece is composed of four thin pieces of wood, joined boxlike to form a post 1 in. square at the top and 3/4 in. at the bottom. An auger bit can be used in making the hole for the candle, but the coping-saw or even the knife alone will do the work. If an auger bit is used, cut out some wood for the "spur" of the bit or it will crack the board. It is also well to make the hole on a larger piece and afterward trim the piece to the required size. A piece of green felt under the candlestick finishes it off. E. E.



Details of a notched candlestick













## WHEN BREAD IS BAKED BY THE MILE

WHERE the gas flames leap and crackle as mile after mile of baking bread passes between them, there can be no guesswork as to the temperature of the ovens half a city block in length.

With thousands of pounds of bread and rolls to be baked every seven days, no chance can be taken on the results. Taylor Instruments for Indicating, Recording and Controlling heat—the Sixth Sense of Industry—are used to record to a fraction of a degree the tremendous heat of the ovens.

Only by using Heat Recording Instruments of the greatest delicacy can wholesale bread bakers be sure of getting the absolutely uniform results that is essential to large-volume manufacturing.

And the home baker can get the same uniform, dependable results by using the Taylor Home Oven Thermometer when baking.

Manufacturers of paints, furniture, rubber goods, metal ware, food products, steel, and all other products that go through heating processes in their manufacturing, need in their plants the Sixth Sense of Industry—Tycos Instruments for Indicating, Recording and Controlling temperature.

### MANUFACTURERS

Tycos Engineers have effected substantial economy for manufacturers in every line of industry by applying the Tycos "sixth sense." Whatever your problem in the indicating, recording or controlling of heat there is a Tycos Instrument to serve you. Write us for literature on any instrument, or type of instrument, and it will be sent promptly. Or if you prefer, our engineers will consult with you on the application of the Tycos Sixth Sense in your plant.

*Taylor Instrument Companies*

Main Office and Factory  
ROCHESTER, N. Y. U. S. A.  
Canadian Plant: Tycos BUILDING, TORONTO



*Tycos—  
for the  
Home*

*Tycos Office Thermometers*  
An aid in promoting human efficiency.

*Tycos Bath Thermometers*  
To enable you to get the most good from your bath.

*Tycos Home Set*  
Bake Oven Thermometer, Candy Thermometer, Sugar Meter. The secret of accurate results in cooking.

*Tycos Wall Thermometers*  
To help you maintain a temperature in your house conducive to good health.

*Tycos Quality Compass*  
To show you the right way in unfamiliar country.

*Tycos Fever Thermometers*  
A necessity in every home.

*Tycos Stormguide*  
Forecasts the weather twenty four hours ahead with dependable accuracy.

*Tycos Hygrometer*  
To enable you to keep the humidity of the atmosphere in your home correct at all times.

Your dealer will show them to you. Ask us, on a postal, for booklets on any of the above.

*Tycos—  
for the  
Medical  
Professor.*



*Tycos Sphygmomanometer*, Pocket and Office type.

*Tycos Urinalysis Glassware.*

*Tycos Fever Thermometers.*  
Bulletins on request.

THE SIXTH SENSE OF INDUSTRY  
*Tycos Temperature Instruments*  
INDICATING • RECORDING • CONTROLLING





# They Have Stopped

## *— with the help of the*



### YOU can do the same

Save the Household Painting Guide on the opposite page, put it up on your wall in a permanent place, and then, every time you go to buy paint, varnish, stain or enamel, look at the "Guide" first.

Surfaces outdoors, constantly exposed, need types of finishes different from those that are indoors and never-exposed. Floors, constantly walked on, need a type of paint or varnish different from those used on woodwork or walls.

In a word, each type or surface calls for its own type of paint and the same is true of varnish, of stain and enamel.

The Household Painting Guide simply makes it easy to select the RIGHT material exactly as a color card makes it easy to select the right color; it stops mistakes in painting.

*Buy and be sure, by looking up  
"Paint Headquarters"*

*and buying from the Household Guide*

The store in your community—perhaps in your neighborhood—displaying the "Guide" and

carrying the correct Sherwin-Williams paints, varnishes, stains and enamels recommended by the "Guide," is "Paint Headquarters." The name is more than a title—it is literally correct because that store gives you service, through the "Guide," far ahead of stores which merely "sell paint." Look for the "Guide" in the window and inside the store.

No matter whether the home decorating that you plan is for a single room or the whole house, the Sherwin-Williams Dep't of Home Decoration will gladly give you individual suggestions if you write them. Ask for free booklet B450, giving practical information, and also for free set of handsome color plates. If you want the most complete book on home decorating ever issued, 177 pages, many beautiful full-page decorative schemes in colors, send 50c (65c in Canada). Write The Sherwin-Williams Co., Dept. B435, 659 Canal Rd., Cleveland, O.



# Mistakes in Painting

## Household Painting Guide

| <div> <div>SHERWIN-WILLIAMS</div> <div>HOUSEHOLD</div> <div>PAINTING GUIDE</div> <div>  <div>TRADE MARK</div> </div> </div> |   |   |   |  |
|--|---|---|---|--|
| SURFACE  | TO PAINT—<br>USE PRODUCT<br>NAMES BELOW     | TO VARNISH—<br>USE PRODUCT<br>NAMES BELOW | TO STAIN—<br>USE PRODUCT<br>NAMES BELOW | TO ENAMEL—<br>USE PRODUCT<br>NAMES BELOW |
| AUTOMOBILES  | S-W Auto Enamel                             | S-W Auto Enamel                           |   | S-W Auto Enamel                          |
| AUTOMOBILE TOPS<br>AND SEATS   | S-W Auto Top and S-W<br>Auto Seat Finishing |   |   |  |
| BRICK  | W-P House Paint<br>S-W Concrete Wall Finish |   |   | W-P House Paint                          |
| CEILING, outside   | W-P House Paint                             | W-P House Paint                           | W-P House Paint                         | W-P House Paint                          |
| CEILING, inside  | W-P House Paint                             | W-P House Paint                           | W-P House Paint                         | W-P House Paint                          |
| CONCRETE   | W-P House Paint                             | W-P House Paint                           | W-P House Paint                         | W-P House Paint                          |
| DOORS, interior  | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |
| Exterior   | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |
| FENCES   | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |
| FLOORS, interior   | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |
| Concrete   | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |
| Parquet  | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |
| FURNITURE, inside  | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |
| Household cabinet  | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |
| IRONING BOARD  | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |
| RADIATORS  | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |
| ROOFS, Shingles  | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |
| SAFES  | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |
| TOYS   | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |
| WALLS, interior  | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |
| WALLS, exterior  | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |
| WINDWORK, interior   | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |
| WINDWORK, exterior   | S-W House Paint                             | S-W House Paint                           | S-W House Paint                         | S-W House Paint                          |

For Removing Paint and Varnish use Tackling Gun or other suitable tool can be used by anyone on any surface.

SHERWIN-WILLIAMS

PAINTS AND VARNISHES

For Cleaning Painted and Varnished Surfaces use Tackling Gun or other suitable tool can be used by anyone on any surface.



For Wood



For Metal

## New!

### SHERWIN-WILLIAMS Payment Plan

Arrangements have now been perfected by Sherwin-Williams whereby the painting of residential property may readily be arranged on a convenient payment basis. Recognized business practice is now therefore made available to the property owner without difficulty or expense. The Sherwin-Williams Paint Headquarters' Dealers will gladly give you full information.

### How To Hire a Painter

Give the job to a *good* painter when you hire a man to paint your house. "Paint Headquarters" will recommend good men. Good painters are worth knowing. *If you hire a painter, hire a good one.*





**VAUGHAN & BUSHNELL**  
Vanadium Hammers are aristocrats among hammers. Made from special formula vanadium steel—handled with the best grade hand-shaved second growth white hickory—designed with a special non-slip claw that grips either a brad or a spike—and equipped with a Vaughan's Expansion Wedge that firmly locks the handle tight—they are made for you craftsmen that buy quality tools.

V & B Unbreakable Planes bear the same reputation as V & B Vanadium Hammers. They are drop forged—not cast—from a solid bar of V & B Supersteel, and stand the falls and accidents that would break an ordinary plane. They are furnished with all vanadium steel blades and walnut handles in the sizes you'll want.

Your hardware dealer will heartily recommend these two tools. Ask to see them when next you are in!

**VAUGHAN & BUSHNELL**  
**MANUFACTURING COMPANY**  
*Makers of Fine Tools*  
314 Carrou Ave. • Chicago, Ill. U.S.A.

## How to Erect an Aerial Pipe Mast

THE erection of aerial masts has often resulted in the marring of attractive lawns or homes with unsightly, makeshift poles. Those radio fans who have attempted to erect neat pipe masts frequently have given up in disgust and discarded the bent, twisted, and unmanageable remains of their unsuccessful efforts. It is almost impossible to erect a 50-ft. mast after the pipes have been assembled, as it will bend, vibrate, and twist.

The most practicable method is to telescope three lengths of different sized pipe. The smallest or upper section should not be less than 2 in. pipe size. Set up the telescoped pipe in a hole 4 or 5 ft. deep. Fill in with concrete or well tamped earth and use three guy wires to brace the largest or lowest section.

Two men, working from ladders placed on opposite sides of the erected pipe, then raise the top or smallest section until it has been lifted three-quarters of its length out of the middle section. A bolt is slipped through a hole previously drilled

for that purpose, so as to prevent this section from telescoping or sliding down within the next larger size.

The middle or second section (now supporting the top or smallest section) then is raised and a bolt used in a similar manner to prevent its telescoping within the largest or lowest section.

Guy wires, which were previously attached to the top of the second section, are fastened to the same anchor posts used for the guys of the lowest section. It is not necessary

to attach guys to the top section, but it is wise to use a single wire to counteract the pull of the aerial wires.

By using this method a 50-ft. mast may be raised in less than one hour. It is important, however, to select pipes that slide or telescope easily. Three 20-ft. lengths will make a mast that will be from 45 to 50 ft. high. Because of the weight of the pipe, it is not advisable to use more than three pieces. One advantage of this method is that the pipes can be painted before erection, and lowered when necessary for repainting.

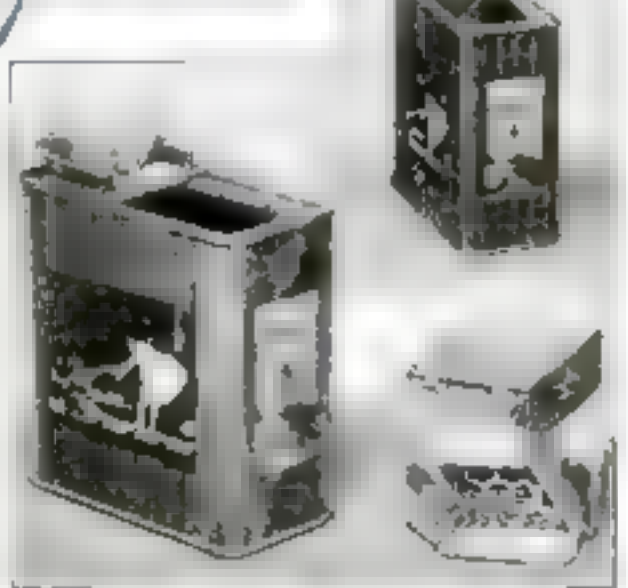


Raising the upper pipe

## Old Can Forms Ash Receiver

THE ash receiver illustrated costs nothing to make, has a large capacity, and will not readily spoil.

It is made from a can that contained toasted almonds. Pictures are pasted over the remaining metal, while the rest of the surface is decorated with panels of purple and yellow, and a small butterfly or moth is pasted on the top.



An ash receiver of large capacity

the lid. This is cut across one-third the distance from the end. One end of it is bent to form a hinge joint around a piece of stout wire or a nail, which is soldered in place as shown.—EDWARD H. FLAHERTY.

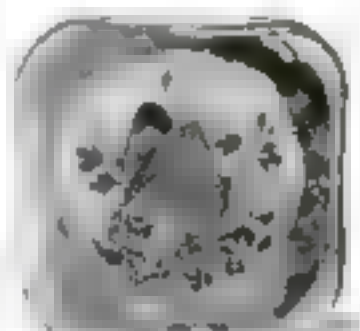
## Butterfly Paperweight Is Attractive Desk Ornament

By Clyde E. Volkens

IF YOU have stored away somewhere a discarded glass paperweight, you can convert it into an attractive desk ornament by replacing the colored print with a small butterfly or moth.

The glass first is cleaned thoroughly. Cut a piece of stiff paper or thin cardboard that will fit the bottom of the paperweight. In the hollow cavity of the glass, place the butterfly so the more attractive side will be seen from the top. Arrange a piece of brightly colored grass, a dainty bit of flower over the butterfly. As a background use a thin sheet of white or stained cotton or the silky down from milkweed pods.

Glue the cardboard to the back of the weight to hold the cotton, flower, and butterfly in place. Acetic glue is excellent for this purpose. It is made by heating 18 parts of glue flakes (previously softened by soaking overnight in a little cold water) with 2 parts of acetic acid until a thick liquid is formed.



A unique paper weight



# CIR-KIT



## More Power per Tube brings Greater Radio Most Economically

### SEE ERLA RECEIVERS

Inherent Erla advantages in power, tone and selectivity are now available in beautiful complete Erla receivers. Retail prices range from \$67.50 to \$225. Both price and performance place Erla receivers among the sensations of radio history.

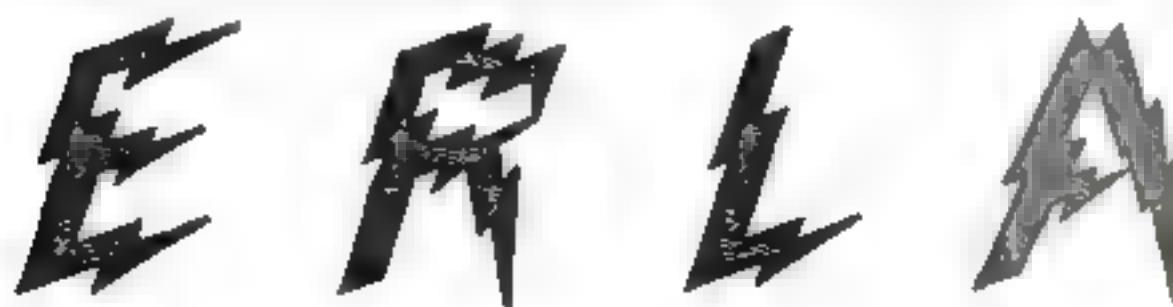
Triple power is the basis of Erla Supereflex records. Tubes, as used in Supereflex, simultaneously amplify received radio frequency currents, reflexed radio and reflexed audio frequency currents. So 1-tube Supereflex rivals the power of conventional 3-tube circuits. And 3-tube Supereflex readily outclasses the ordinary five!

Only such power can give you the thrill of Supereflex distance and volume; always with Erla crystal-pure tone—and with uncanny selectivity that gets what you want when you want it.

This finer radio is brought within the reach of all by Erla Supereflex CIR-KIT, the factory-sealed carton of genuine Erla apparatus for building Supereflex yourself. Anyone can follow the CIR-KIT assembly plan perfectly, using only screwdriver and pliers, without drilling or soldering.

Pride of workmanship, extreme economy, priceless radio performance, are yours in Erla Supereflex CIR-KIT. Select your model at the Erla store. 1 to 5 tubes, antenna and loop types.

**Electrical Research Laboratories**  
Department S, 2500 Cottage Grove Avenue, Chicago





# The Fine Finish of BROWN & SHARPE TOOLS

## Is Part of Their Quality— An Indication of Excellence

High accuracy, together with superiority in every point of tool design, are basic qualities in Brown & Sharpe Tools. Fine finish is one of these qualities. Just examine closely any Brown & Sharpe Tool. Its fine finish is an indication of its excellence—an excellence which can be had only in Brown & Sharpe Tools.

Have you seen the new Brown & Sharpe Small Tool Catalog No. 29? Let us send you a copy.

**Brown & Sharpe Mfg. Co.**  
Providence, R. I., U. S. A.

# BROWN & SHARPE TOOLS

"Standard of the Mechanical World"



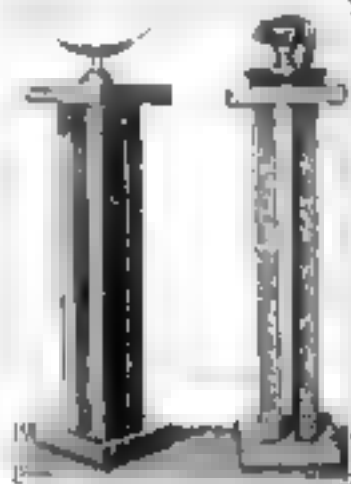
## The Home Workshop

### Few Tools Needed to Build Sturdy Wooden Plant Stands

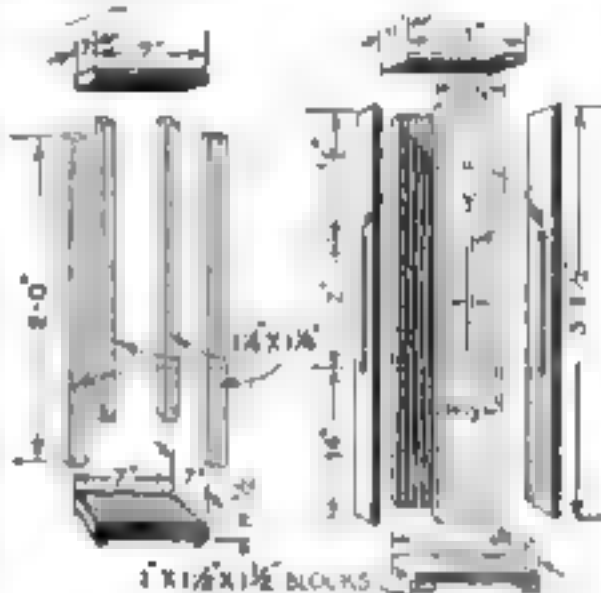
THERE is a Robinson Crusoe streak in all of us. If the first trial of a joint in either woodworking or metalworking proves an error, what of it? The second or third will be right.

Even the would-be mechanic who has never made as much as a box, will learn how true this is if he will try his hand at making a pair of pedestals or stands by either of the methods shown in the accompanying drawings.

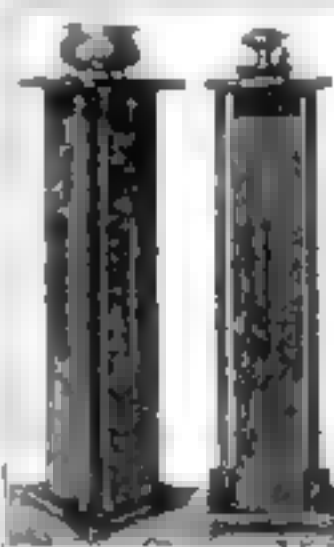
The tools needed are a saw, a plane, a hammer, a coping or compass saw, brace and bits, a square, and a nail-set. You can get the wood planed to size at the mill. All



The first pair



Details of the first pair are shown at the left; of the second pair at the right



The second pair

you need to do is to saw off the pieces to the length shown, square the ends, and put them together. No mortises or tenons or doweled joints are used.

Allowing for some waste, the material needed for the first pair of pedestals illustrated is as follows.

- 2 pcs. 1 1/2 in. square, 9 ft. long
- 1 pc. 1 1/2 in. thick, 7 in. wide, 3 ft. long
- 8 large rubber-headed tacks
- 15 lb. tempering finishing nails
- 2 1/2 lb. No. 0 sandpaper

Saw the 9-ft. pieces into eight 24-in. lengths, seeing that the ends are square. Cut the 3-ft. piece to make four 7-in. squares, which will form the tops and bottoms. Draw diagonal lines across the

(Continued on page 199)

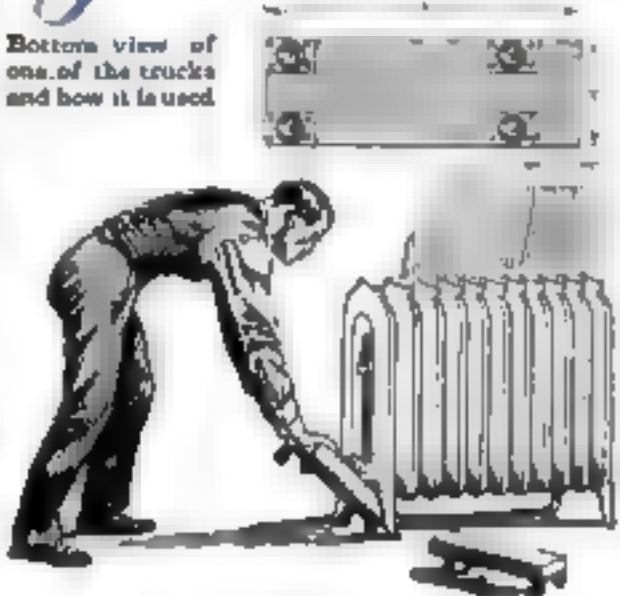


The Home Workshop

Simply Made "Skates" Aid in Handling Heavy Radiators

AFTER my father strained his back moving a radiator, I devised the two small trucks or "skates" illustrated. Each one is made by screwing four casters on a wooden block, 2 by 4 by 12 in. One pair of casters is set back from the end about 2 in., the other is even with the end. In use, the overhanging end of the skate is placed under the end of the

Bottom view of one of the trucks and how it is used.



radiator. By pressing down on the other end of the skate, the radiator is lifted sufficiently to allow the skate to slip under. With a skate under each end, the radiator can be wheeled easily.—R. B.

Sturdy Wooden Plant Stands

(Continued from page 108)

corners of both sides of these pieces so that the legs and nails may be placed accurately. The uprights are kept 1 3/4 in. inside the edges. Two tenpenny nails are driven into each joint. The rubber tacks are driven into the base near the corners. The completed pieces are stained and waxed or stained and given a coat of flat varnish.

The material required for the second pair of pedestals is as follows:

- 2 boards 1 by 3 1/2 in. by 14 ft.
- 1 board 1 by 11 in. by 4 ft.
- 1 strip 1 by 1 1/2 by 16 in.
- A few sixpenny and tenpenny nails

The 14-ft. boards are cut into eight lengths of 37 1/2 in. The ornamental holes are marked in the center of each piece, beginning 14 in. from the bottom and running to 11 1/2 in. from the top. After boring the holes, cut out the 1/2-in. strip with a compass saw.

The four top and bottom pieces are 11 in. square. They are fastened to the sides 1 in. from the edges with four tenpenny nails at each joint. The eight feet are sawed from the 1 by 1 1/2 in. strip and fastened at the corners of the bottom with two sixpenny nails in each joint.

Sandpaper the pieces before assembling, making the strokes lengthwise with the grain. The wood for the tops and bottoms should be planed before being sandpapered. After assembling, the edges are chamfered or rounded off.

The heads of the nails are set 1/4 in. deep and the indentations filled with putty that is colored with stain.—J. T. GARVER



My Life Work

The finest shaving cream you will ever know

Let me send you a tube to try

By the Chief Chemist

GENTLEMEN,

In less than 4 years, Palmolive Shaving Cream has gained top place. Its success is a business sensation.

Will you do us the courtesy of trying it? Men literally are flocking to it.

We asked 1,000 men

Our first step was to ask 1,000 men what they most desired in a Shaving Cream. All of them agreed on four things.

But one requirement, and the greatest of all, is something no man mentioned. That is, strong bubbles which support the hairs for cutting.

We made 130 trials or tests

We made up 130 formulas which we discarded

Then we attained, by many times over, the best Shaving Cream in existence. Today Palmolive Shaving Cream is winning men by the millions, as they try it.

Don't change from the cream you like now until you see what Palmolive Shaving Cream does. But make this test. Try ten shaves, and let the results show if we have excelled the rest.

5

New Delights

- 1—Multiplies itself in lather 250 times.
- 2—Softens the beard in one minute.
- 3—Maintains its creamy fullness 10 minutes on the face.
- 4—Strong bubbles hold the hairs erect for cutting.
- 5—Fine after-effects, due to palm and olive oil content.

To add the final touch to shaving luxury, we have created Palmolive After Shaving Talc specially for men. Doesn't show. Leaves the skin smooth and fresh. Try the sample we are sending free with the tube of shaving cream. Clip coupon now.

THE PALMOLIVE COMPANY (Del. Corp.), Chicago, Ill.

PALMOLIVE SHAVING CREAM



10 SHAVES FREE

and a can of Palmolive After Shaving Talc

Simply insert your name and address and mail to Dept. R 460, 1515-16th St., Chicago, Ill. The Palmolive Company. We'll send you a sample of our famous Palmolive Shaving Cream and a can of Palmolive After Shaving Talc. Clip coupon now.





## A Keener Edge...

For jungle undergrowth, sugar-cane—perhaps even tropic politics—cutting tools must be razor sharp and shaped just so. It's the file that keeps them properly edged, adding impetus to even primitive industry.

From the gold mines of Alaska to rubber plantations on the Amazon—wherever tools need sharpening and files must render constant and faithful service—NICHOLSON FILES are preferred.

In your home, too, you can quickly sharpen every cutting edge with a NICHOLSON FILE—one of the many reasons why they belong in your tool equipment.

**NICHOLSON FILE CO.**  
Providence, R. I., U. S. A.

# NICHOLSON FILES

~a File for Every Purpose



## The Home Workshop

### Fumeless Chicken Brooder Costs Little to Construct

By L. B. Robbins

WHILE there are many types of brooders for raising chicks, the one illustrated has been tried out with the greatest success for several seasons by the builder. It can be built for practically nothing and will raise nearly from 50 to 60 chickens until they are six weeks old. It is used indoors.

Stenous fumes from the lamp—the most dreaded thing to contend with in brooding—practically are eliminated, yet

Brooder with  
hover removed

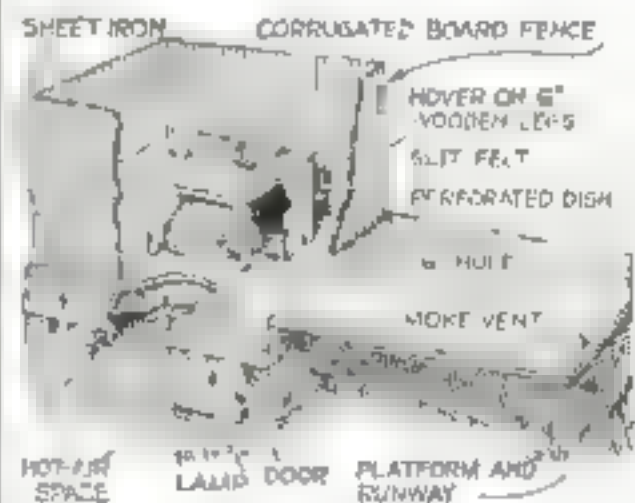


the heat is distributed so that the chicks can secure any degree of warmth.

The body of the brooder consists of a wooden frame 32 in. square by 12 in. wide. Across the top of this frame tack a piece of sheet zinc or iron and turn the edges down all around. A strip of sheet asbestos between the edges of the board and the metal will make a tight joint. This completes a strong, boxlike structure with an open bottom and a metal top.

Nail four pieces of 3-in. furring around the box and over the metal. Use long wire nails to go through the furring and the metal and into the frame. Then floor this second structure over with thin, matched (tongued-and-grooved) boards, making as tight joints as possible. This construction forms a 3-in. air space above the lower frame.

Cut a 6-in. hole in the center of the flooring and invert an old cooking dish



Heat from the lamp is transmitted through a metal diaphragm to a hot-air radiator

over it, fastening it to the floor with small brads. The dish should be punched full of small holes to radiate the warmth from the hot-air chamber.

A square hole is sawed in one side of the body of the brooder, as indicated, and fitted with a sliding door.

The hover consists of a thin wooden panel 24 in. square set on four wooden legs 6 in. high. Fit some sort of a handle

(Continued on page 115)



## The Home Workshop

### Sealing-Wax Aids in Making Toys and Models

**SEALING-WAX** is a useful medium for making interesting little toys as well as colorful models such as the one illustrated, which is an amateur theatrical scene, built on the scale of 1/4 in. to 1 ft.

The background is a piece of illustration board painted with water colors. The wall and gate are still drawing paper. The snow on the wall is white wax. By drawing the soft wax slowly off the edge and then cutting the threads with a scis-



Miniature scene for amateur theatricals made with sealing-wax on illustration board and paper

sors, realistic drifts and icicles are formed. The lamppost is a 20-penny nail standing on its head and covered with black and white wax.

When the wax is soft it can be molded easily with the fingers or with small knife blades and large needles. Cyinders or spheres are formed by twirling the wax carefully over an alcohol flame. As the last step, a brilliant gloss can be given to the work by running it quickly through the flame.—KENNETH M. SWEENEY.

**INSOLES** for shoes may be cut from an old felt hat. They are fully as satisfactory as commercial insoles and cost nothing. If thoroughly washed, a piece of old felt hat makes a good rubbing felt for finishing woodwork. The felt also is useful for cutting gaskets.—W. L.

### Fumeless Chicken Brooder

(Continued from page 119)

to the center of the top and tack a 6-in. strip of felt around the edges. Slit up the felt at intervals of 2 in., so that the chicks may pass in and out of the hover.

For heating use a regulation brooder lamp or a common lamp with short chimney. Light it and place it under in the center of the lowest compartment. Provide a few holes along the top edge of the wide frame, below the metal ceiling, to carry off the fumes. The air in the 3-in. space above then becomes heated without odor. The heat passes out of the holes in the heating drum and warms the interior of the hover. An average size flame will maintain 90 degrees in cold weather.

Corrugated board, tacked about the brooder as indicated, can be used to fence the young chicks in for the first few days and then extended as they increase in age and size. An extension platform can be hinged to the front to furnish the birds more floor space and finally let down to form an inclined runway when they are allowed to have an outside run.

This brooder may be cleaned readily, is safe, and will raise strong, healthy chicks.



## WORTH WHILE TOOLS

**T**HERE is satisfaction in the ability to tackle odd repair jobs about the home; and if one has the energy and determination to do some of this work himself, the savings in time and money will be considerable.

The kind of tools used often determines the quality of the work. To be sure of the best results, get the right tool for the purpose. There's a large variety of Pexto Tools made in all practical styles and sizes. You can't go wrong if you insist on these century-famous tools.

For the mechanic and for general home use, the Pexto Samson Ratchet Bit Brace, illustrated above, will give a lifetime of dependable service and stand up under the severest "roughing." Its ball-bearing chuck gives the Pexto Brace a grip that never lets go. It will hold round, square or taper-shank drills. The Samson is the kind for you—it's a boon to the "home mechanic."

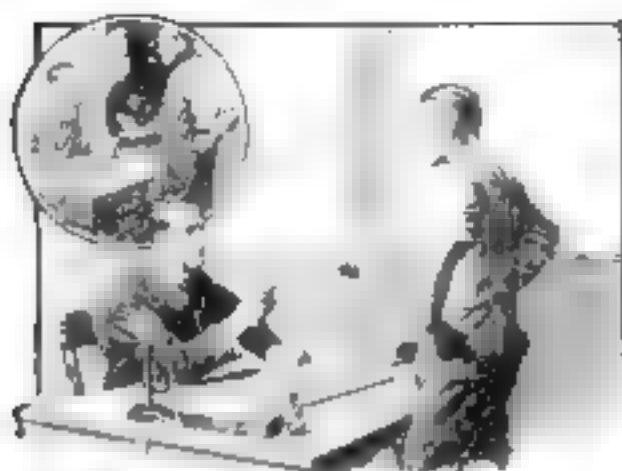
All Pexto Tools are backed by a century of tool making experience. The line consists of Bit Braces, Hammers, Chisels, Screw Drivers, Hatchets, Snipe Squares, Wrenches, Pliers, Pruning Shears, and many other small tools. It is easy to procure Pexto Tools as they are carried by practically all progressive dealers. Booklets covering our lines are available for free distribution. Ask for them.

**THE PECK, STOW & WILCOX CO.**

SOUTHINGTON, CONN., U. S. A.







## Don't tell me you never had a chance!

"Four years ago you and I worked at the same bench. I realized that to get ahead I needed special training, and decided to let the International Correspondence Schools help me. I wanted you to do the same, but you said, 'Aw, forget it!' You had the same chance I had, but you turned it down. No, Jim, you can't expect more money until you've trained yourself to handle bigger work."

There are lots of "Jims" in the world—in stores, factories, offices, everywhere. Are you one of them? Wake up! Every time you see an I. C. S. coupon your chance is staring you in the face. Don't turn it down.

Right now over 150,000 men and women are preparing themselves for bigger jobs and better pay through I. C. S. courses.

You can join them and get in line for promotion. Mark and mail this coupon, and find out how.

### INTERNATIONAL CORRESPONDENCE SCHOOLS

Box 2444 D. Scranton, Penna.

Without cost or obligation on my part, please tell me how I can qualify for the position or in the subject before which I have marked an X.

#### BUSINESS TRAINING COURSES

- |  |   |
|--|---|
| <input type="checkbox"/> Business Management             | <input type="checkbox"/> Salesmanship               |
| <input type="checkbox"/> Industrial Management           | <input type="checkbox"/> Advertising                |
| <input type="checkbox"/> Personnel Organization          | <input type="checkbox"/> Better Letters             |
| <input type="checkbox"/> Traffic Management              | <input type="checkbox"/> Show Card Lettering        |
| <input type="checkbox"/> Business Law                    | <input type="checkbox"/> Stenography and Typing     |
| <input type="checkbox"/> Banking and Banking Law         | <input type="checkbox"/> Business English           |
| <input type="checkbox"/> Accounting (including F. A. T.) | <input type="checkbox"/> Civil Service              |
| <input type="checkbox"/> Navigation and Accounting       | <input type="checkbox"/> Railway Mail Clerk         |
| <input type="checkbox"/> Bookkeeping                     | <input type="checkbox"/> Commercial School Subjects |
| <input type="checkbox"/> Office Secretary                | <input type="checkbox"/> 15th National Subjects     |
| <input type="checkbox"/> Spanish                         | <input type="checkbox"/> Illustrating               |

#### TECHNICAL AND INDUSTRIAL COURSES

- |   |  |
|---|--|
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Architecture              |
| <input type="checkbox"/> Electrical Lighting    | <input type="checkbox"/> Architectural Blue Prints |
| <input type="checkbox"/> Mechanical Engineering | <input type="checkbox"/> Locomotive and Boiler     |
| <input type="checkbox"/> Mechanical Drafting    | <input type="checkbox"/> Architectural Drafting    |
| <input type="checkbox"/> Machine Shop Practice  | <input type="checkbox"/> Concrete Builder          |
| <input type="checkbox"/> Patterns and Dies      | <input type="checkbox"/> Structural Engineering    |
| <input type="checkbox"/> Gas Engine Operating   | <input type="checkbox"/> Chemistry                 |
| <input type="checkbox"/> Coal Engineering       | <input type="checkbox"/> Pharmacy                  |
| <input type="checkbox"/> Mining and Metallurgy  | <input type="checkbox"/> Automobile Work           |
| <input type="checkbox"/> Metallurgy             | <input type="checkbox"/> A. C. and D. C. Engines   |
| <input type="checkbox"/> Steam Engineering      | <input type="checkbox"/> Agricultural and Poultry  |
|   | <input type="checkbox"/> Mathematics               |

Name \_\_\_\_\_ 2-6-24  
Street \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_

Occupation \_\_\_\_\_  
Persons residing in Canada should send this coupon to the International Correspondence Schools, Limited, Montreal, Canada.

## Why Not Make \$100 A WEEK?

It's Easy this New Way!

Why shiver along as a manager's assistant when you can make \$75-\$100 a week (not working) this beautiful hand tailored FREE RAIN-PROOF CAP? Just think—O. W. Allen of California made \$40.00 in one day's joyful world!

### \$10 a Day in Spare Time

Hundreds of men are reporting profits of \$10 a day in their spare time. This cap is so superior to store caps that every man wants one. Every Taylor Cap is RAIN-PROOF—the moisture can't soak in. Choice of finest wools and latest styles. No experience needed. Get a cap for yourself FREE. Write at once for our FREE Selling Outfit. TAYLOR CAP MANUFACTURERS, Dept. 2-2, Cincinnati, Ohio.

## The Home Workshop

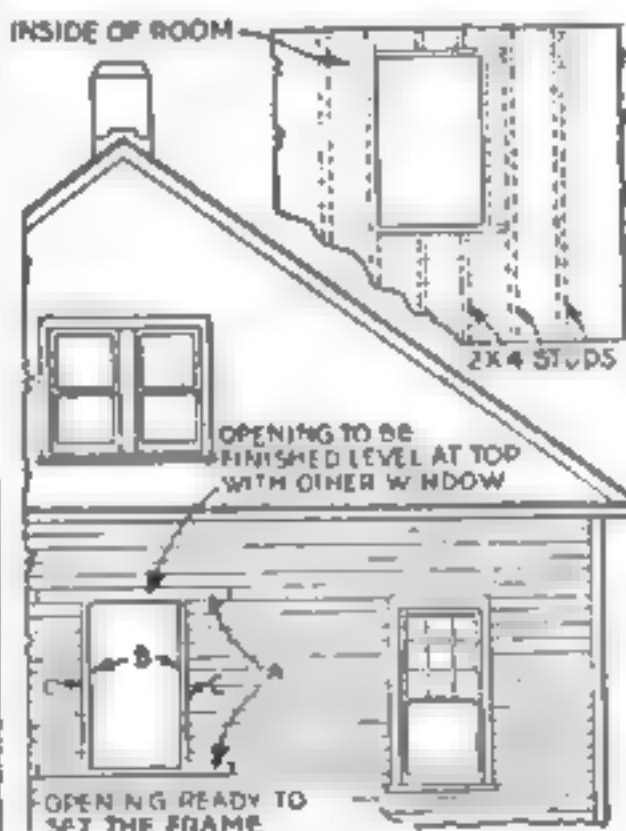
### How to Cut a Window Opening in a Frame House

TO CUT a new window opening in a frame house presents no great obstacle to the skillful home worker.

The location for the window in the room is fixed by the individual circumstances in each case. It remains to be seen, however, if in that position it would injure the appearance of the residence from the outside. This may be judged by measuring from the outside corner of the house, allowing about 6 in. more than the distance across the room or rooms as measured inside.

Should there be a window above or below that comes almost in line with the place for the opening, keep the new window exactly in line, if possible, even if the location is not so desirable on the inside.

If the window is smaller in height than others on that side of the house, it is usu-



Inside and outside view of opening cut and ready for placing a new window frame

ally best to make the new window line up at the top with the others, as illustrated. This brings the window higher from the floor from the inside, but this is not unusual and often no disadvantage.

Before cutting the opening, tap the plastered wall to find the location of the studs or vertical members of the house frame. If by changing the position an inch or so, the cutting out of one side stud can be avoided, do this; it saves much time.

For double-hung sash, that is, the ordinary sliding sash with weights, mark the proposed opening on the wall 6 1/4 in. wider and 5 in. higher than the sash size. For example, if the pair of sash are 2 ft. 6 in. by 5 ft., the opening should be 3 ft. 1/4 in. by 5 ft. 5 in. If casement sash without weights is used, the allowance in width need be only 2 1/4 in. more than the sash.

Cut out the plaster on the lines with a chisel, breaking out a strip about an inch wide to expose the lath. Then cut through the lath with a coarse compass

(Continued on page 113)

## Tried by a thousand trails



CARLETON CANOES are built to stand the gaff of years of the hardest service. They do it too. In over a quarter of a century of manufacture we have never had one discredited user.

Carleton Canoes are wonderfully light. They are beautifully balanced, fast and surprisingly easy to handle. And Carleton Canoes are unusually reasonable in price.

Send for our new illustrated catalog. It gives prices and complete information. Write for your free copy today. THE CARLETON CANOE CO., 74 First Street, Old Town, Maine, U. S. A.

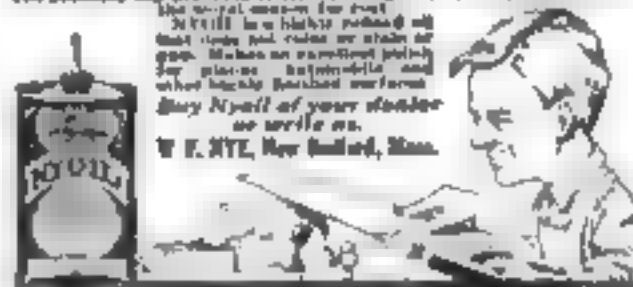
## CARLETON CANOES

## Protect Your Tools with - NYOIL

Your valuable tools can be protected absolutely from rust. Cover all your tools with NYOIL. Keep a can in your tool chest. The patented oil prevents rust from forming. Rustproof—Rustless in the most severe weather.

NYOIL is a highly polished oil that coats and seals all tools. Makes an excellent polish for brass, steel, and other highly finished surfaces. Buy NYOIL at your dealer or write us.

W. F. NYE, New Bedford, Mass.



### Carrying Case FREE with 3 ft. Telescope

See how you can get a 3 ft. telescope and carrying case for only \$1.00. The carrying case is made of leather and is very strong. The telescope is made of brass and is very clear. It is the best telescope you can get for the price.

Send No Money. We will send you the telescope and carrying case for only \$1.00. Write us today for our free catalog.

## Delivered to you Free

For a 30-day trial on approval, 1 set of 44 styles, colors and sizes of the famous Mead Bicycle. Express prepaid. Bicycles \$21.00 and up.

\$5 a Month. If desired, Mead Bicycles and tires can be had on a 5-month plan. Write us today for our free catalog.

Tires. Mead Bicycles and tires can be had on a 5-month plan. Write us today for our free catalog.

## RADIO SETS—AUTO BODIES

SEND FOR THE INTERNATIONAL CATALOG. Our new price list. Full line of Radio Sets and Auto Bodies. Write us today for our free catalog.



International Sales Works, 114 W. Ohio St., Dept. 3, Chicago, Ill.

## \$25.00 in Prizes

See top of page 3 in front of book for full details

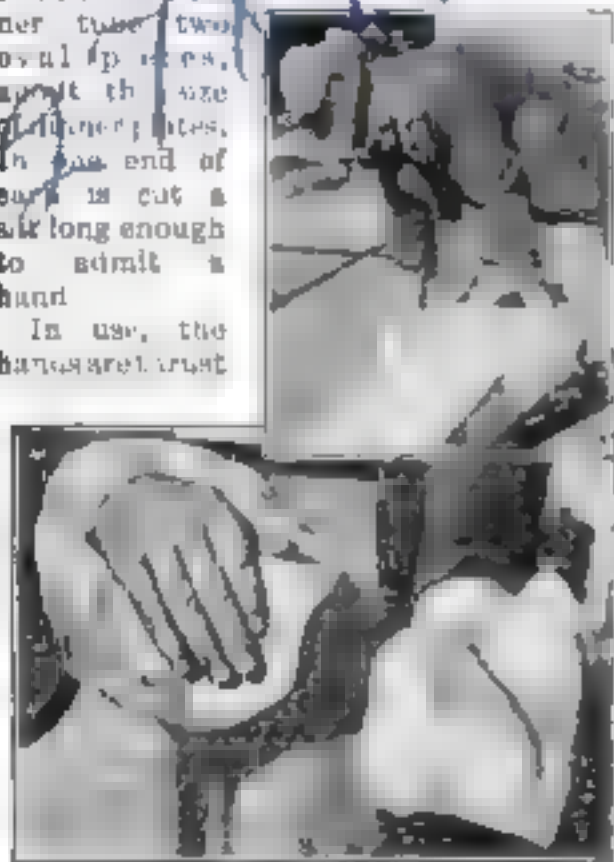


### The Home Workshop

#### Pads Protect Your Hands when Lifting Rough Objects

FOR rough, heavy lifting, nothing protects the hands better than the pads illustrated. They are made by cutting from an old inner tube two oval pieces, about the size of dinner plates. In one end of each is cut a slit long enough to admit a hand.

In use, the hands are thrust



through and the pads are pinched between thumbs and forefingers. Besides being inexpensive, they have the added virtue of not making the hands perspire as do gloves.—E. M. L.

#### How to Cut a Window Opening

(Continued from page 112)

saw. Also cut out the 2 by 4 in. studs that have to be removed.

You then are ready to work from the outside. Although at times this may be done from a ladder, it is a great advantage to rig up a scaffold opposite the opening to be cut.

It usually will be best to order the window frame, sash, and inside trim complete. When doing this, request that the outside casing be sent loose. The casing then will come tacked lightly to the frame.

Measure the frame with the casing on and mark the opening carefully on the beveled siding of the house with a straight-edge and plumb.

In cutting the opening, the edge of the sheathing (B) should project about 2 in. beyond the edge of the siding (C) and a section of the siding (A) should be removed both at the top and bottom of the frame, to be replaced after the frame is set up. The drip cap on top of the frame should be covered with metal and painted before the upper piece of siding is put in place. At the bottom of the sill a groove will be found into which the bottom piece of the siding fits. Take care to nail the casing very solidly to the wall and frame.

When boring holes in wood without a depth gage, it is possible to have all the holes the same depth by counting the number of turns taken for the first hole and using the same number of turns for all the others.—M. E. S.

# SIMONDS CIRCULAR SAWS

WHEN you specify SIMONDS in ordering a solid tooth circular saw, or any other style of saw, you can be certain that its quality is protected not only by Simonds near-century of experience in making the finest cutting edges of tempered steel, but that constant laboratory tests and development work assure you that your selection represents the very last word in cutting tool manufacture.

No matter what your cutting problem may be, put it up to Simonds, either through your supply house or dealer or direct.



SIMONDS SAW AND STEEL COMPANY

Fitchburg, Mass.

"The Saw Makers"

Established 1832

Branch Stores and Service Shops in Principal Cities

# SIMONDS

Pronounced SI-MONDS

## SAWS FILES KNIVES STEEL



# If You Can Hum a Tune

## Send for this New Offer

If you can hum a tune you can now learn to play a musical instrument quickly and easily. Think of the pleasure music will bring you. You are always popular and sure of a good time. And there is no easier way to earn money.

### Learning to Play Made Easy

**Free** We now furnish free with every Wurlitzer instrument a Special Scholarship in a nationally famous school of music. This school has taught thousands to play by a special home study method. Many of its graduates are successful professional musicians. Whether you wish to play for pleasure or for profit choose your favorite instrument and send for this New Offer now! Use the coupon below.

### Free Trial—Easy Payments

You may have any Wurlitzer instrument for a week's free trial in your own home. No obligation to buy. Payments are arranged in small monthly sums—a few cents a day will pay for your instrument.

### Send for Free Book

Illustrated and described every known musical instrument—more than 5000 articles, many of them shown in full outline. Special offers on complete outfits. All genuine Wurlitzer instruments, buying direct from Wurlitzer saves you money. Wurlitzer instruments are the result of 50 years experience. Praised by musicians in every sphere of music for artistic quality, rich tone and workmanship.

We also give you our Free Trial, Easy Payment Plan and Free Scholarship offer. No obligation. Send coupon now.

**WURLITZER**

Elmhurst Chicago  
New York San Francisco



### Send this Coupon

The Rudolph Wurlitzer Co., Dept. 1754  
117 E. 4th St. Cincinnati 225 S. Wabash Ave. Chicago  
120 W. 42nd St. New York 250 Stockton St. San Francisco  
Send me your Free Book on musical instruments. Also your Free Trial, Easy Payment plan and Special Free Scholarship Offer. No obligation.

Name.....

Address.....

City..... State.....

Instrument.....

**WURLITZER**

Copyright 1925, Rudolph Wurlitzer Co.

## The Home Workshop

### Bench Drill Press Made of Pipe and Fittings

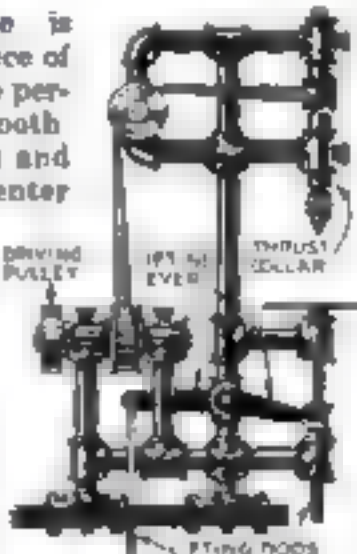
ALTHOUGH made of common pipe fittings and pipe, the small bench drill press illustrated is capable of doing fast and accurate work.

The driving shaft is turned from a piece of cold rolled steel. A thrust collar is located at the chuck end and the end is turned to a Morse taper to suit the chuck to be used. The standard tapers used as bearings are rabbitted to suit the shaft and tapped where convenient to receive grease cups.

The faceplate is made from a piece of 1/2-in. steel plate perfectly flat and smooth. A hole is drilled and tapped in the center of plate to fit the end of the lifting rod. The rod is cold-rolled steel.

The lever block in which the end of the lifting lever slides may be either round or square, with flanges on top and bottom. The lifting levers are made from pieces of 3/4-in. flat steel. A square hole in the lever engages a fulcrum shaft, which passes through a pipe cross. A rod is connected with the back lever and passes through a hole in the bench to a treadle underneath. This foot method of feeding the faceplate upward allows both hands to be free.

The pulleys are of cast iron. A selection of speeds can be obtained, of course, by using a pair of step pulleys.—F. N. C.



Details of simple made bench

### Mercury Improves Friction Contacts in Radio Parts

TO OVERCOME the tendency of the rotor shafts of radio condensers and couplers to oxidize and cause a loss of efficiency in instruments designed to use

#### 1/8" HOLE IN BUSHING



#### GROOVE FOR MERCURY

An improved condenser bearing with the groove. The shaft and bushing should be absolutely clean. When assembled, the groove is filled with mercury by means of a pipette or medicine dropper. This insures good conduction.—PHILIP A. JUDD, Portsmouth, Ohio.

friction contacts instead of "pig tails," some radio fans who pride themselves upon their neat workmanship use mercury to insure good contacts. The method is illustrated.

A groove about 1/16 in. deep is filed around the shaft so that it will be inside the bushing when assembled. A 1/4-in. hole is drilled in the bushing to coincide with the groove. The shaft and bushing should be absolutely clean. When assembled, the groove is filled with mercury by means of a pipette or medicine dropper. This insures good conduction.—PHILIP A. JUDD, Portsmouth, Ohio.



## It Looks Funny

—but it isn't—when you're far from help

VERY likely means an expensive tow-in job—which would cost a whole lot more than a selected Set of Snap-On Wrenches that would always be on hand to help you out of trouble.

Spring is in the air—the open road is calling. Play safe this season—go over your car and tighten up all the nuts and bolts before you start on a trip. It's a quick job with Snap-Ons. Take your Set with you and relieve that gnawing anxiety about road trouble. It will bring a new element of safety that will enhance the pleasure of motoring.



This selected Set for the Ford is equipped with a chart of great value to the owner in making repairs. Ask us about the selected Set for your car.

## Snap-on

INTERCHANGEABLE

Socket Wrenches

Snap-Ons are the choice of over 250,000 garage mechanics. Look for the name without it we stretch in a genuine Snap-On.

**SNAP-ON WRENCH CO., MFRS.**  
Milwaukee, Wisconsin

**Motor Tool Specialty Co.**

Distributors 14 E. Jackson Blvd., Chicago  
Send me particulars. My address is—



## The Home Workshop

### Spring Overhauling Lengthens Life of Your Heating Plant

By Orion O. Gakes

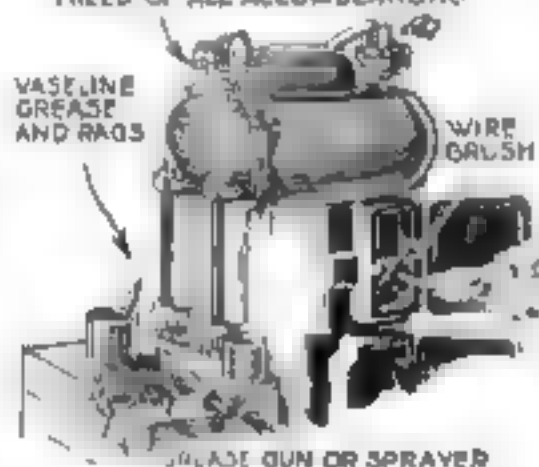
Heating and Ventilating Engineer

AS SOON as fire is no longer needed in the spring, clean out thoroughly all flues and the upper portions of your steam-heating or hot-water boiler with a wire flue brush. Rub all surface well to remove soot, ashes, and scale. Part of this material will fall on the grate, part will be drawn out through the various cleanout doors, and part will lodge in the smoke bonnet.

When the flues and upper works are well cleaned, remove all the ashes from the ash pit and clean the pit. The smoke pipe should be removed and scraped with the flue brush, and the smoke bonnet, which now will be accessible, should be freed of all accumulations.

Next obtain a plant sprayer or oil gun and spray all the interior surfaces of the boiler with crude oil or light machine oil.

SMOKE PIPE REMOVED AND BONNET FREED OF ALL ACCUMULATIONS



After being thoroughly cleaned, all metal surfaces are sprayed with oil or grease

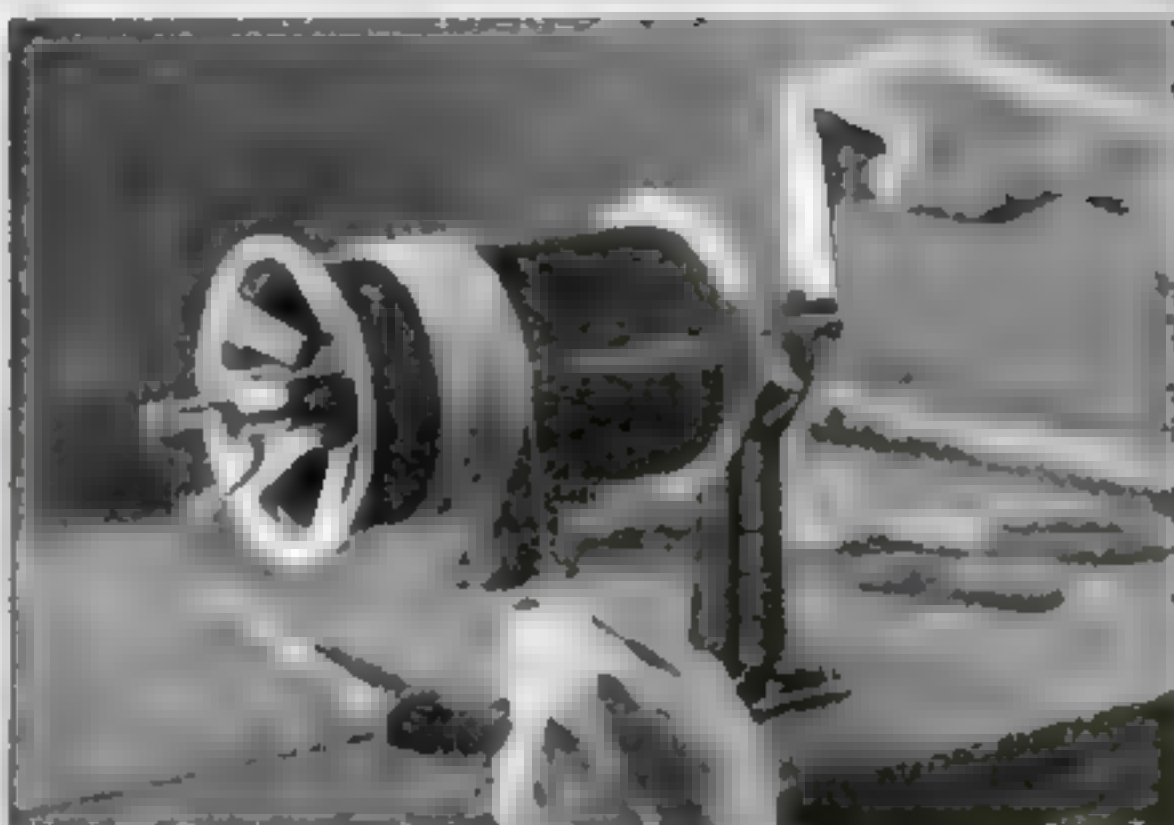
If convenient you may use oil taken from the crankcase of your automobile for this purpose. For the exterior portions use vaseline or a light grade of automobile grease applied with a rag.

The importance of this work is because all flue doors, fire doors, clinker doors, and cleanouts are ground on the edges at the factory to make contact with the frames. When these ground joints are unprotected during the summer, the moisture of the air forms sulphurous acid by combining with soot and this in turn acts on the cast-iron or steel surfaces with a corrosive action. When ready to be used in the fall the doors will be found coated with scale and the hinges and pins may be so affected that the close and accurate contact of the parts is destroyed. The condition becomes worse each succeeding year.

One of the most important requirements for efficient operation of a fire is that all door openings or joints of any kind fit tightly. It will be seen that ill fitting, corroded doors mean poor combustion and loss through fuel waste.

If the boiler is of the metal jacketed type, the entire outer surface should be coated with grease. Treat the smoke pipe in the same manner as the inside of boiler and store it in a dry place if possible.

(Continued on page 116)



## A new tool that radio fans have been waiting for

NOW the radio amateur can "wind his own" as quickly and as expertly as any professional coil winder—and at one-tenth the cost. This Goodell-Pratt Coil Winder is a new tool made especially for winding tubular coils, inductance coils, and transformers for superdyne and neutrodyne circuits.

Holds any cylinder of cardboard, bakelite, or fibre up to 4 3/4 inches in diameter and 7 inches in length. The outer aluminum driving disc is adjusted to the cylinder length by a sliding collar, which can be locked at any point on the spindle with a thumb screw. The outside face of this collar is cut at an angle, affording a cam action against the button on the disc hub, which exerts a continual tightening effect on the cylinder. And because both discs are cone-shaped, the cylinder is centered automatically.

The spring wound around the spindle prevents it from turning backward and releasing the tension on the coil wire. If unwinding becomes necessary, merely raise the loop end of the spring.

Nicely finished in red and black enamel, and natural aluminum, with all exposed steel parts well polished. Length over all 14 1/2 inches, weight 3 pounds.

**Other tools for radio builders.** Write for special radio tool folders, which show all the Goodell-Pratt radio tools, many of which are new and exclusive Goodell-Pratt inventions.

GOODELL-PRATT COMPANY, Greenfield, Mass., U. S. A.

Makers of Mr. Punch



No.

695

Coil Winder

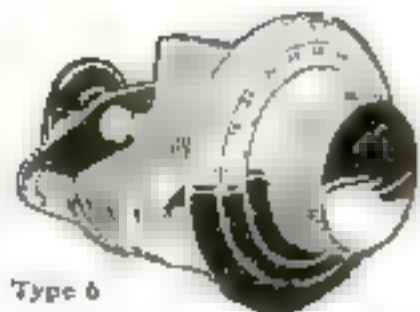
# GOODELL-PRATT

1500 GOOD TOOLS



# S-E-L-E-C-T-I-V-I-T-Y

## To A New Degree



Type 6

A RESULT OF THE  
IMPROVED  
MICROMETER DIAL

## U. S. Tool Condensers

AGAIN in the van as a result of constant research and painstaking experimenting—U. S. Tool announces an improved micrometer dial, a boon to radio reception and a new degree in the selectivity of DX stations.

The separate knob turns the ENTIRE rotor slowly, accurately, too precisely to slip by any station within reach. Stations passed by on ordinary condensers are instantly detected with the micrometer dial. Factory-tested and guaranteed to be within 3%, plus or minus, of the indicated capacity.

FACTORY  
GUARANTEE

Write  
for  
Literature

U. S. TOOL COMPANY, INC.

127 Mechanic St.

Newark, N. J.

Mfrs. of Special Tools, Dies, Jigs, Automatic Machinery and Sub Process

# New Elto Invention

The  
Propello  
Pump

by Ole Evinrude

## Ends All Pump Troubles

There is not a single moving part in the new Elto Pump. Yet a flood of water flows constantly through the cooling system. It never fails. The rudder openings scoop up the water as the motor runs, straining it to keep out clogging materials. The whirling Propeller Blades push and force the water into circulation. Once started, the water siphons continuously.

Works Perfectly at all Speeds—and in all Waters

Slow down to a fish-getting trolling speed, or open up the throttle wide for a race; go anywhere in muddy or sandy water—fresh or salt. As long as your engine is running, you know the Propello Pump is working. No clogging valves. No more clogging pipes. No more over-heated engines. No more expensive repairs.

Elto advantages are 50% More Power, More Speed, Less Weight per Horse Power, Instant Starting Every Time, Push On or Reverse, Safe Rudder Steering, Larger Bearings, Sturdier Working Parts, Longer Life. Write for catalog. ELTO OUTBOARD MOTOR CO. Ole Evinrude, President, Dept. W, Manufacturers' Home Bldg., Milwaukee, Wis.

Found  
Only on

Elto

Ole Evinrude's  
New 3 H.P. Fast  
LIGHT TWIN

## The Home Workshop

### Overhauling a Heating Plant

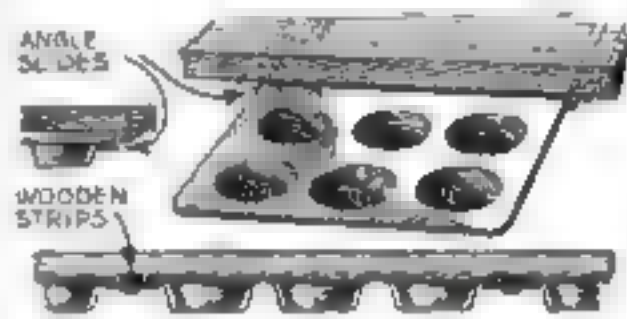
(Continued from page 115)

The boiler should be filled completely by adding water to that already in the boiler and not by emptying and refilling. The water in the boiler has been repeatedly distilled and therefore has less action during summer than new water.

Oil or grease all moving or wearing parts of the pressure regulator and cover, if desired, with an oily cloth to prevent the accumulation of dust through the summer. If there is a thermostat, wipe it and cover with a cloth.

### Biscuit Pans as Receptacles for Small Hardware

ORDINARY 10-cent biscuit pans, painted black with screen enamel to prevent rust, are excellent containers for small hardware, such as screws, nuts, tire valves, and washers. The pans may be



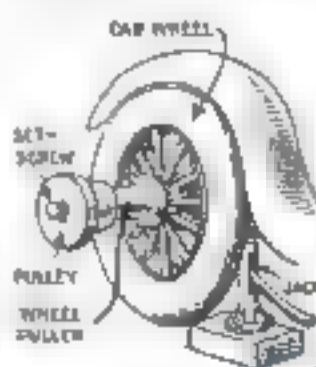
The biscuit pans slide on runners placed under the bench top or under a shelf

hung to the bottom of a shelf or bench on runners bent from 18-gauge galvanized sheet steel or made from 1/2 by 1 in. strips of hand iron and 1/2-in. square wooden spacers. The runners should be screwed, not nailed, in place. R. C. T.

### A Large Glue Scraper Made from an Old Hand Saw

A PLAIN wood scraper about 4 by 10 in., made from an old file, preferably a stiff one, is very handy in knocking off the hardened excess glue from joints preparatory to planing, scraping, and sandpapering large surfaces such as table and dresser tops. It does not bruise the surface and is so large that ample elbow grease may be applied.—J. A. H.

### Belt Pulley Fastened to Auto with Ordinary Wheel Puller



WISHING to use my automobile for power purposes, I fastened a pulley to a rear wheel by means of an ordinary wheel puller.

A wooden pulley was sawed out to the right size to give the speed desired. This was fastened to the wheel puller with the setscrew. I jacked up the rear end of the car, screwed the puller on the hub, turned the pulley to a smooth finish, and belted it to a saw.—S. H. S.



## The Home Workshop

### How to Re-Cane Chairs

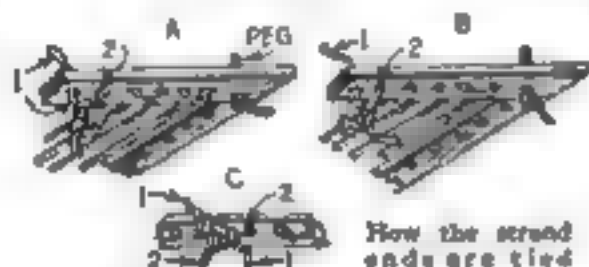
(Continued from page 96)

it in the groove. Then pour more thin, hot glue into the groove, making sure that the entire length is covered and that there is a surplus amount to be forced out as the spline is driven into place.

Take one end of the spline, which has been soaked previously in water to make it pliable, and drive it in at the center of the back rail. Tap it lightly all the way around until it meets in the back. Cut off the surplus with a saw or sharp chisel. While doing this, put a block under the end. Avoid scratching the chair.

With a narrow wedge or a small block of wood, drive the spline down into the groove all the way around until it is flush with the surface of the chair. Wash off the surplus glue carefully with hot water.

After the cane has dried thoroughly, which will take two or three days, it will be as tight as a drum head. If you have been careful to get an even tension on the surface when driving in the wedges, the surface will be entirely free from wrinkles or puckers. The chair now is ready for use, but to make sure that the cane will remain taut in various temperatures, it is well to give both lower and upper



surfaces several coats of good white shellac, after which varnish may be applied.

If the chair you are to cane has no spline and, therefore, has been woven by hand, a different procedure is necessary. The diagrams on the preceding page give the correct method to follow.

Cane for hand weaving may be purchased by the hank of 1000 ft., and comes in various sizes such as fine-fine, fine, medium and coarse. The medium size is used most. You will need about 300 ft. for one chair and about 5 ft. of binding cane.

After removing the old cane by running a sharp knife or chisel across the strands on the bottom and lifting it out from the top, clean up with soap and water and a good stiff brush.

All cane is moistened for not more than three minutes before using. While the diagram explains the steps in caning a square bottom, the method is the same regardless of the shape. If the chair is wider in the front than at the back, count the holes at both places. Say there are 17 in the back and 19 in the front; start your caning from the left rear hole and go to the second hole in the front. If there were 15 holes in the rear rail and 19 in front, you would begin in the left rear hole and go across to the third hole in the front rail. For circular seats the point to keep in mind is to have your cross strands parallel.

Referring to the diagram (page 116), run one end of the cane first through A about 2 in. and hold it with a peg. Run

(Continued on page 118)



## In fairness to your family and yourself

Of course you want your family to enjoy all of the advantages of modern living. But, have you provided them with the modern way of writing?

Have you considered what a wonderful help a Remington Portable will be to that boy of yours, and what an invaluable training it will give him for his life's work—whatever it may be? Do you realize the many precious hours it will save for everybody in the home?

Wouldn't it be worth a great deal to you to have this always ready helper on hand to take care of your personal writing? Countless homes now find the Remington Portable indispensable, and we are sure that yours is no exception.

The Remington Portable is the choice of most people the world over, because it has every feature common to the big machines, is easy to operate, does beautiful work always, is compact, and carries its table on its back.

Sold everywhere. Easy payment terms, if desired. Write today for illustrated "For You, For Everybody."

"We believe we make the best typewriter ribbon in the world — and its name is PARAGON"

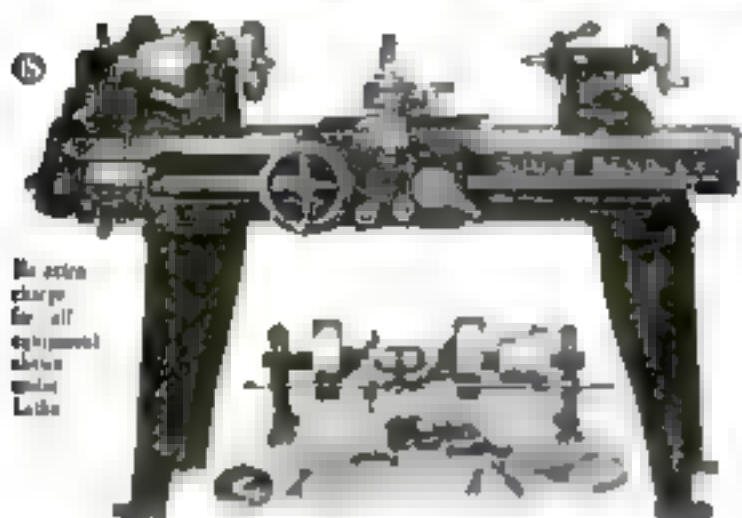
Address Department 67  
REMINGTON TYPEWRITER COMPANY  
214 Broadway, New York

## Remington Portable

THE RECOGNIZED LEADER IN SALES AND POPULARITY



# Use Your Lathe



It's the  
cheap  
for all  
equipment  
about  
under  
Lathes

**While  
Paying  
for It**

**Now You Can  
Get This  
11 in. x 3 1/2 ft.  
Quick Change Gear**

## South Bend <sup>Screw Cutting</sup> Lathe

**—for only \$284. Easy Payments if Desired**

Here is your chance to get a brand new, latest improved South Bend Lathe on convenient terms. We ship Lathe upon receipt of first payment, allow 30 days' trial, and you have the use of the Lathe while paying for it. In this way it helps earn its own cost. We make this liberal offer on any South Bend Lathe \$1,000 in use in U. S. and 64 Foreign Countries.

For example, in plants of 2 largest Steel Companies, 8 largest Auto factories, 3 largest Railroad shops, by U. S. Government, etc.

**SOUTH BEND LATHE WORKS,**  
217 East Madison St., South Bend, Ind.

Gentlemen: I would like to know your  
price and terms on a Lathe.  
Please send Free Catalog.

Name \_\_\_\_\_  
Address \_\_\_\_\_

**SOUTH BEND**  
Lathes embody  
38 major im-  
provements  
made within  
the last 2 years.  
Unsurpassed in  
accuracy and  
efficiency.

**CATALOG FREE!** Write or send coupon today. Free Book shows 66 styles in all sizes, from small Bench Lathe to largest Factory Lathe. Compare prices with what you ask and remember every South Bend Lathe carries a liberal guarantee and 30 day trial order. Send for Catalog today.

**South Bend Lathe Works, 217 EAST MADISON STREET, SOUTH BEND, IND., U.S.A.**

## The Home Workshop

### Tank for Cheap Sprayer Made from Oil Drum

A STEEL drum such as may be had at low cost from almost any garage, can be made into an efficient sprayer tank for poultry yards, orchards, and gardens.

Pipe fittings with a hose and suitable shut-off nozzle are attached to one of the openings of the drum. Through the cap or plug of the other opening a hole is



A homemade spraying tank for use in the garden, orchard, or poultry yard

drilled to admit an auto tube stem. This stem is attached with suitable gaskets so as to be airtight.

After the drum has been filled with the spraying mixture and placed on a flat wheelbarrow, so that it may be rolled occasionally to keep the mixture agitated, an auto tire pump is connected with it and used to obtain sufficient pressure for spraying.—GEORGE G. McVICKER.

### How to Re-Cane Chairs

(Continued from page 117)

across and down through B, and hold with a second peg. Move the peg each time to insure tightness, but through the whole procedure do not strain.

The diagonals are woven in the fifth step. Start at A and run the strand under the strands woven in the first and third steps and over those of the second and fourth steps. Take great care to follow this order throughout. If the cane does not lie flat and straight, some mistake has been made. Be sure that the cane runs into the squares and not between two strands. Fasten one end (L.S.) by slipping it under one of the strands on the under side of the chair. Continue as shown, following the holes alphabetically.

In the seventh step lay the binding cane X over the holes and bring the medium cane Y up on one side and down on the other as shown. Keep the medium cane pulled very tightly and when you have gone completely around, tie down the loose end under the last loop.

If the reader of this article happens to be a boy who is anxious to earn a little money, he will find that almost every home in his neighborhood has a chair stored away somewhere that needs to be re-caned. A charge of \$1 for putting in the machine-woven cane and \$2 for the hand-woven will be a very reasonable price, yet, after he has gained experience, it will net a nice little sum in comparison to the labor expended.

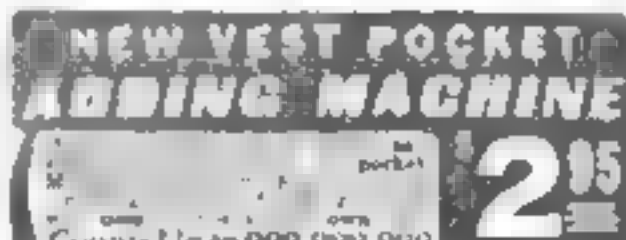


## Easy to Draw Cartoons

When Shown in the RIGHT WAY

Some of the cleverest cartoonists and comic artists learned how to draw in their spare time by following Cartoonist Evans' Simple and Easy to Learn Method and are now MAKING BIG MONEY. Send one of your drawings, and let M. Evans see if you have ability and receive the Portfolio of Cartoons and full details about the course. It is not expensive.

**THE W. L. EVANS SCHOOL OF CARTOONING**  
222 Leader Building Cleveland, Ohio



**NEW VEST POCKET ADDING MACHINE**  
Counts Up to 999,999,999  
10 Days Trial  
AGENTS

# LEARN RADIO

Become a big-pay man in the greatest industry of all time. Quickly, easily and right at home, you can fit yourself for highest salary positions, or you can cash in on your spare time. The call is urgent for mechanics, operators, designers, inspectors. Unlimited, fascinating opportunities.

**I WILL TRAIN YOU AT HOME TO A RADIO EXPERT**

Under my practical, easy to understand, instruction—you can learn in an amazingly short time. No previous experience is necessary. Every branch of radio becomes an open book to you. You learn how to design, construct, operate, repair, maintain and sell all forms of Radio apparatus. My methods are the latest and most modern in existence.

**FREE** Wonderful home construction tube receiving set of the latest design. **Write Today** "Radio Facts" **FREE**  
R. G. McLaughlin, Radio Engineer, RADIO ASSOCIATION OF AMERICA Dept. 44, 615 Broadway, New York, N.Y.







## Home Workshop Chemistry

*Simple Formulas that Will Save Time and Money*

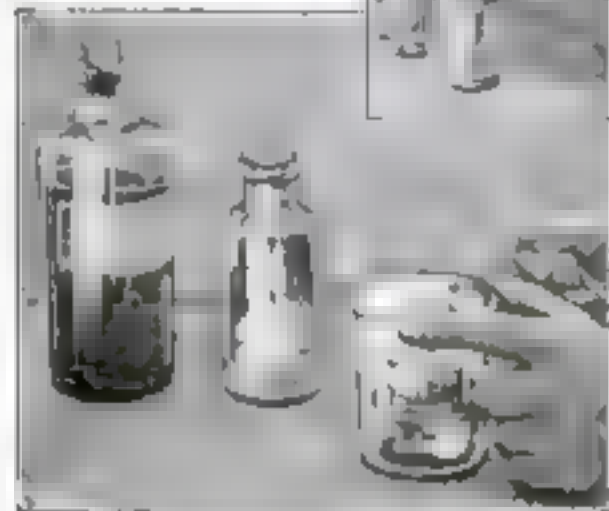
**L**OW temperature can be obtained easily through the use of relatively common chemicals.

Dissolving one part of sodium nitrate in an equal part of water, the quantities being taken by weight, will give an average drop of about 25° C. or 45° F.

Equal quantities of ammonium nitrate and water also can be used. The drop in temperature will vary from 50° F. to about 10° C.

A chemical reaction will serve the same purpose. Eight parts by weight of Glauber salts (sodium sulphate) are used

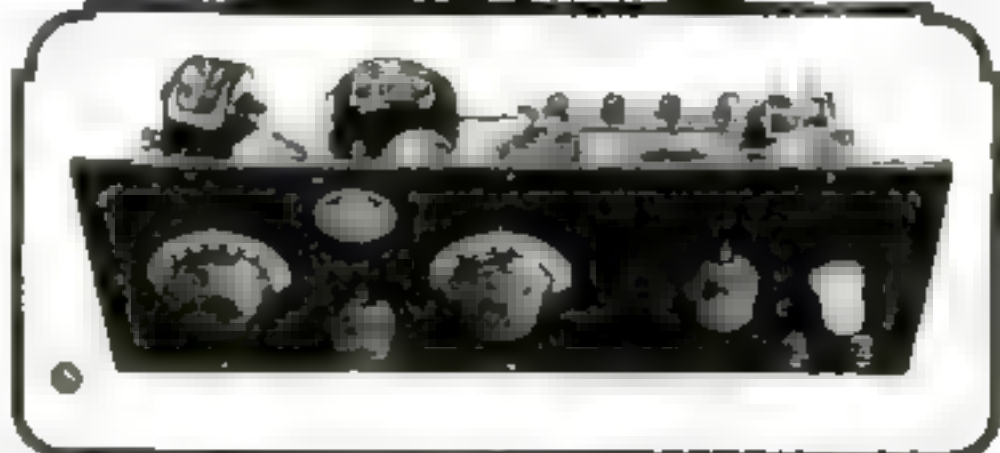
Making chemicals to produce a red granite at night and making ice in the cold mixture (below)



together with five parts by weight of dilute hydrochloric acid, made by pouring the acid slowly into an equal quantity of water and stirring it. Let the acid solution cool before pouring it into the container holding the crystals. A double decomposition takes place and ordinary salt, or sodium chloride is formed together with sulphuric acid.

By this method ice can be made on a small scale. Into a large container, preferably non-metal because of the acid, place the Glauber salts and add the dilute acid. Into a smaller and taller vessel place pure tap water and immerse the vessel in the freezing mixture. In from five to 10 minutes, ice will be formed. It can be used without danger, for the chemicals used in the freezing mixture do not come in contact with the water in the smaller vessel. Other uses for such freezing mixtures will suggest themselves.

Liquids that do not freeze readily also can be prepared. A saturated solution of table salt in water will remain fluid to approximately 0° F. or about 18 degrees below zero on the C scale. This solution will not corrode or affect the metal parts of an engine. Equal parts of glycerine and water also can be used and it has the advantage of not crystallizing when the water evaporates. In both cases, when the water evaporates, just add pure water



## Now You Can Afford — a modern precision-made set which "cuts through"

¶ Tuned radio frequency for distance and selectivity, reflex for economy, the wonderful loudspeaker tone quality and volume which comes with ALL-AMERICAN precision manufacture—all are present in this non-radiating three-tube receiver. ¶ And, owing to the economy of "wiring it yourself," ALL-AMAX SENIOR costs less than a finished one-tube set of equally high quality. ¶ Take it home today from your favorite radio store; wire it this evening, and "tour the country" before you retire for the night! Price \$42.

*All-Amax Sets come completely mounted on panel and baseboard with full instructions for wiring.*

The RADIO KEY BOOK has, concentrated in its 48 pages, the answers to those questions you have been wondering about. It is a radio education in itself. Send 10 cents, coins or stamps, for your copy

**ALL-AMERICAN RADIO CORPORATION**  
PIONEERS IN THE INDUSTRY

2668 Coyne Street

Chicago

### Other ALL-AMERICAN

There is now an ALL-AMERICAN Transformer for every radio need—Audio Frequency, Radio Frequency and Power Amplifying (Push-Pull) Transformers and Super-Fine Parts for Intermediate Frequency work.

### All-Amax Junior



A one-tube reflex set that brings all the locals on the loudspeaker with wonderfully clear tone quality, or tunes them out and gets real distance Non-Radiating. Price \$22.00

# ALL-AMERICAN

*Largest Selling Transformers in the World*







## The Home-Workshop

### Giving Wings to Your Speedster

(Continued from page 120)

connect either with the inlet or outlet water connections and are gear or belt driven from the fanshaft or the camshaft.

In the selection of a water pump, care should be taken to obtain one that may be fastened securely at several places to the cylinder block and can be relied upon to stay right. This is important, especially in regard to the propeller shaft of the pump or gland.

With the engine speed in the neighborhood of 2000 r.p.m., the weight of the pistons and connecting rods becomes an important factor. Unless the engine is to be fitted with special aluminum or alloy pistons and light-weight connecting rods, the methods of weight reduction illus-

#### Summary of Alterations that Will Improve Your Speedster

**IGNITION**—Substitute single-spark system or high-tension magneto

**LUBRICATION**—Increase oil-trough supply and add auxiliary oil pump

**COOLING**—Use pump system for circulation

**PISTONS**—Use alloy pistons, or lighten cast-iron pistons by drilling

**CONNECTING RODS**—Drill out webs of the original connecting rods

**CRANKSHAFT BALANCE**—Pistons and connecting rods must be uniformly drilled to maintain equal weight. Balance flywheel exactly after removing magnets

**VALVES**—Substitute tractor valves  $\frac{1}{8}$  in. larger in diameter

**EXHAUST MUFFLER**—Remove present muffler and install straight tubular exhaust

**WHEELS**—Wire wheels are recommended for flexibility; they also reduce overheating of tires

**GEARS**—Three-to-one or 2 $\frac{1}{2}$ -to-one gears in differential permit of higher car speed, without excessive engine speed

**LUBRICANT**—Only best grades of oil, with high viscosity and flash point, to be used

trated in the drawings on page 83 should be applied.

The weight of the piston is reduced by drilling a series of  $\frac{1}{8}$ -in. holes between the second and bottom ring and also below the bottom ring. In these locations the holes do not noticeably impair the strength of the pistons and are effective in reducing weight and improving the lubrication.

The connecting rod is lightened in the same manner. The smallest hole is  $\frac{5}{16}$  in. in diameter; the other holes increase gradually to  $\frac{3}{8}$  in. They are drilled through the web of the rod.

To improve the lubrication at the big end bearing, it is advisable to drill two  $\frac{1}{8}$ -in. holes into the bearing from above. These conduct a portion of the draining oil on the rod to the bearing.

It is essential that each piston and connecting rod be exactly alike in weight so as to insure balance.

Overhead valve attachments are obtainable for use on the Ford engine. These unquestionably increase the power. It is

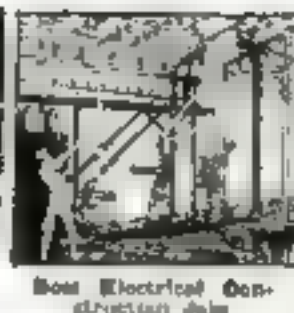
(Continued on page 122)



Be Superintendent of an Electrical Power Plant



Own your own Electrical Rep. Shop, Electric Fixture, Supply or Appliance Store



Do an Electrical Construction Job



Be an Electrical Contractor



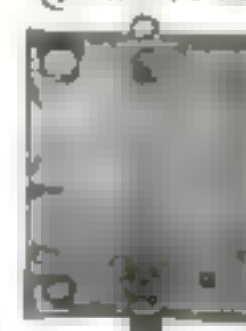
## 22 Chief Engineer Dunlap Electrical Engineers

This is not a one-man, one-idea school. 22 famous Engineers and Executives of the following corporations and universities helped me make Dunlap-train the most complete and up-to-date:

|                                  |                                       |
|----------------------------------|---------------------------------------|
| General Elec. Co.                | Columbia University                   |
| Edison Co.                       | Dartmouth College                     |
| Crocker-Wheeler                  | Massachusetts Institute of Technology |
| Cutter-Hammer                    | University of Vermont                 |
| Mrs. Co.                         | Armour Inst. of Technology            |
| American Tel. & Telegraph Co.    | And Many Others                       |
| Westinghouse Electric & Mfg. Co. |                                       |
| Western Elec. Co.                |                                       |
| Underwriters Laboratories Inc.   |                                       |

## GO INTO ELECTRICITY

Wiring Outfit



### I give you these 4 Electrical Outfits!

You don't have to leave your home or quit your job. You don't need post-graduate Laboratory courses when you are Dunlap-trained. I send you these 4 costly, complete Electrical Outfits, all the Laboratory and Shop apparatus you need to understand Electrical laws, theories and principles easily and quickly. Not one penny extra for this equipment.

### Earn While Learning

As early as your 16th year you can get special training in wiring, Radio, Electrical repairing, motors, etc. and you can do it at home. I'll send you instruction into cash. It's no trick to earn enough in a few months to pay for your training. Or anything else you want to do.

## Chief Engineer Dunlap AMERICAN SCHOOL

Dept. E-475, Drexel Ave., and 58th St. Chicago, Ill.



After you finish my Training!

If you're now earning less than \$40 a week enroll for my home training in Electricity and I will guarantee under bond in writing to find you a position at 50% raise in pay within sixty days after you finish, or I will refund every penny of your money. Mine is the only home-study Electrical School to make this guarantee.

## \$60 to \$200 a Week!

Enormous demand for all-around Electrical Experts as Power Plant Superintendents, Chief Electricians, Foremen of Construction, Electrical Draftsmen, Radio Engineers, etc. And with my training you can go into business for yourself with little capital and make \$3000 to \$12000 a year.

## GO INTO ELECTRICITY — the Business of a Million Opportunities

While you're at it, while you're spending your time and money to be a success, Train for the big-pay Boss jobs in the world's fastest growing industry. The world's work is now being done by Electric power. Autos, ships, buildings, aeroplanes, all electric equipped. Electric lights, everywhere. Think of Radio, Telephones, Telegraph, Electric railways. This business DOUBLED in the last 9 years, and they say it will double again in the next 6 years!

### Mail Coupon at Once

I have a surprise offer for you! Complete information, free catalog, my sensational guarantee of a 50% raise, and my confidential surprise offer. Make it right away!

## JOB and RAISE COUPON

Chief Engineer Dunlap, AMERICAN SCHOOL, Dept. E-475, Drexel Ave. & 58th St. Chicago

Send me at once complete information about becoming an Electrical Expert, also guarantee of job and 50% raise, also your confidential SURPRISE offer.

Name \_\_\_\_\_  
 No. \_\_\_\_\_  
 City \_\_\_\_\_  
 State \_\_\_\_\_



## It's a Race Not a Run!

TODAY'S machines make a *race* of production, not a *run*. From the new design, new speed-gains; new time-savings.

How many pieces per minute will it add to the best records yet? Stop-watch and counter give the answer!

How to feed in material—speed out the product—still *faster*? Your experiments, your improvements will tell, and tell *exactly* in the production-records on a

# Veeder

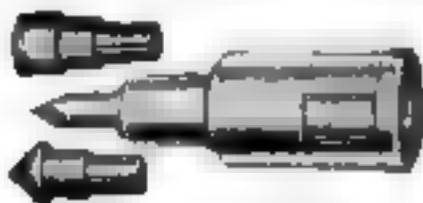
The large Revolution Set-Back Counter below records the output of any machine where a shaft-revolution indicates an operation.



Sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figure-wheels, as illustrated, \$ 0.00—subject to discount. Cut less than one-half size. Set-Back Rotary Ratchet Counter, to record reciprocating movements as on presses, \$11.50 (list). Smaller counters from \$2.00 up.

### Speed Counter

Here's the handiest instrument for finding revolutions-per-minute of a shaft or flywheel. You hold the tip of the counter against end of revolving shaft, press lightly when the second hand of your watch comes to 0: release pressure when minute is up. A spring clutch controls the recording mechanism.



(Cut less than 1/2 size.)

The Veeder Speed Counter enables you to keep motors, engines, generators, line shafting and machines operating at efficient speeds. Price, with two rubber tips (as illustrated) \$3.50.

**FREE**—The 86-page Veeder booklet of counters for all machines and development-work

**The Veeder Mfg. Co.**  
44 Sargeant St., Hartford, Conn.

## The Home Workshop

### Giving Wings to Your Speedster

(Continued from page 121)

possible to improve the engine, however, without this expenditure. Ford-tractor valves can be used in the ports, increasing the valve diameter  $\frac{1}{8}$  in. This amount must be removed from the valve ports; that is, the diameter must be increased  $\frac{1}{8}$  in. For this purpose it is sometimes possible to use a sharp valve-seat reamer, grinding down the reamer to obtain the size. It is obvious that these valves must be ground to a perfect seat.

The back pressure caused by the use of a muffler decreases the engine power and is to be avoided. One successful method of accomplishing this is illustrated. For open road work the cap is removed.

Wire wheels are recommended as representing the most desirable change from the wooden spoke type. These wheels have elasticity and exceptional strength. The heat generated by the tires, especially on hot days, is radiated more readily by these wheels and the tire temperature is kept down.

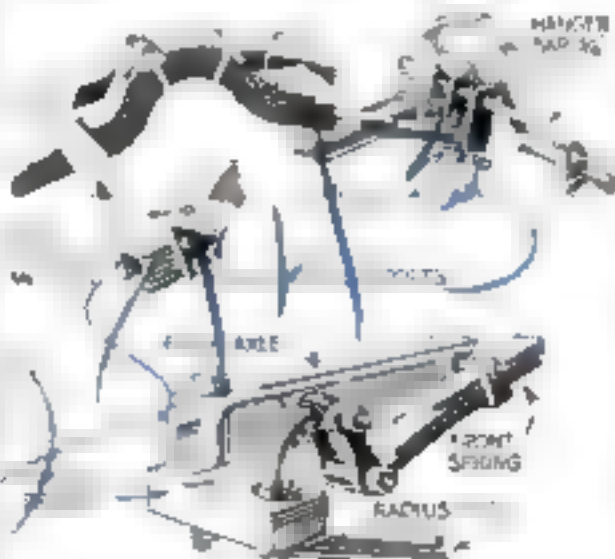
It is advisable to change the drive pinion and ring gear in the differential either to the ratio of 3 to 1 or to the ratio of 2.5 to 1. It hardly pays to make these gears as they are obtainable at a reasonable cost.

These engine changes are not expensive or difficult to make. They are merely a matter of knowing what to do. The changes suggested embody the result of long experience in making fast cars faster.

A tabulation of the alterations under different headings is given elsewhere to aid you in selecting improvements you wish to adopt and in preparing a list of purchases to be made before undertaking the work of adding speed to your speedster.

### Underslinging a Ford Speedster to Obtain a Racy Appearance

MANY amateur mechanics who have converted their light cars to the speedster type by the removal of the regulation body and the installation of



How the front and rear springs are lowered without making any elaborate alterations.

bucket-type seats, large gasoline tank, and rear tool-carrier, are disappointed in the general appearance. The elevated frame seems top heavy.

To lower the frame 2 or 3 in. insures a

The only belt with the Patented Comfort Feature, which combines absolute comfort, perfect trousers support, and prevents curling and binding at the sides.

## BRAXTON

### THE BELT FOR MEN

Handsome Jewelry Buckles. Many beautiful leathers and finishes. At all the best dealers.

**The Perkins-Campbell Co.**  
New York   Cincinnati   Chicago

The Very Latest in Radio

# Radio Book

## Free

The book full of Radio Recipes  
Many 4-6-8-10-12-14-16-18-20-22-24-26-28-30-32-34-36-38-40-42-44-46-48-50-52-54-56-58-60-62-64-66-68-70-72-74-76-78-80-82-84-86-88-90-92-94-96-98-100-102-104-106-108-110-112-114-116-118-120-122-124-126-128-130-132-134-136-138-140-142-144-146-148-150-152-154-156-158-160-162-164-166-168-170-172-174-176-178-180-182-184-186-188-190-192-194-196-198-200-202-204-206-208-210-212-214-216-218-220-222-224-226-228-230-232-234-236-238-240-242-244-246-248-250-252-254-256-258-260-262-264-266-268-270-272-274-276-278-280-282-284-286-288-290-292-294-296-298-300-302-304-306-308-310-312-314-316-318-320-322-324-326-328-330-332-334-336-338-340-342-344-346-348-350-352-354-356-358-360-362-364-366-368-370-372-374-376-378-380-382-384-386-388-390-392-394-396-398-400-402-404-406-408-410-412-414-416-418-420-422-424-426-428-430-432-434-436-438-440-442-444-446-448-450-452-454-456-458-460-462-464-466-468-470-472-474-476-478-480-482-484-486-488-490-492-494-496-498-500-502-504-506-508-510-512-514-516-518-520-522-524-526-528-530-532-534-536-538-540-542-544-546-548-550-552-554-556-558-560-562-564-566-568-570-572-574-576-578-580-582-584-586-588-590-592-594-596-598-600-602-604-606-608-610-612-614-616-618-620-622-624-626-628-630-632-634-636-638-640-642-644-646-648-650-652-654-656-658-660-662-664-666-668-670-672-674-676-678-680-682-684-686-688-690-692-694-696-698-700-702-704-706-708-710-712-714-716-718-720-722-724-726-728-730-732-734-736-738-740-742-744-746-748-750-752-754-756-758-760-762-764-766-768-770-772-774-776-778-780-782-784-786-788-790-792-794-796-798-800-802-804-806-808-810-812-814-816-818-820-822-824-826-828-830-832-834-836-838-840-842-844-846-848-850-852-854-856-858-860-862-864-866-868-870-872-874-876-878-880-882-884-886-888-890-892-894-896-898-900-902-904-906-908-910-912-914-916-918-920-922-924-926-928-930-932-934-936-938-940-942-944-946-948-950-952-954-956-958-960-962-964-966-968-970-972-974-976-978-980-982-984-986-988-990-992-994-996-998-1000-1002-1004-1006-1008-1010-1012-1014-1016-1018-1020-1022-1024-1026-1028-1030-1032-1034-1036-1038-1040-1042-1044-1046-1048-1050-1052-1054-1056-1058-1060-1062-1064-1066-1068-1070-1072-1074-1076-1078-1080-1082-1084-1086-1088-1090-1092-1094-1096-1098-1100-1102-1104-1106-1108-1110-1112-1114-1116-1118-1120-1122-1124-1126-1128-1130-1132-1134-1136-1138-1140-1142-1144-1146-1148-1150-1152-1154-1156-1158-1160-1162-1164-1166-1168-1170-1172-1174-1176-1178-1180-1182-1184-1186-1188-1190-1192-1194-1196-1198-1200-1202-1204-1206-1208-1210-1212-1214-1216-1218-1220-1222-1224-1226-1228-1230-1232-1234-1236-1238-1240-1242-1244-1246-1248-1250-1252-1254-1256-1258-1260-1262-1264-1266-1268-1270-1272-1274-1276-1278-1280-1282-1284-1286-1288-1290-1292-1294-1296-1298-1300-1302-1304-1306-1308-1310-1312-1314-1316-1318-1320-1322-1324-1326-1328-1330-1332-1334-1336-1338-1340-1342-1344-1346-1348-1350-1352-1354-1356-1358-1360-1362-1364-1366-1368-1370-1372-1374-1376-1378-1380-1382-1384-1386-1388-1390-1392-1394-1396-1398-1400-1402-1404-1406-1408-1410-1412-1414-1416-1418-1420-1422-1424-1426-1428-1430-1432-1434-1436-1438-1440-1442-1444-1446-1448-1450-1452-1454-1456-1458-1460-1462-1464-1466-1468-1470-1472-1474-1476-1478-1480-1482-1484-1486-1488-1490-1492-1494-1496-1498-1500-1502-1504-1506-1508-1510-1512-1514-1516-1518-1520-1522-1524-1526-1528-1530-1532-1534-1536-1538-1540-1542-1544-1546-1548-1550-1552-1554-1556-1558-1560-1562-1564-1566-1568-1570-1572-1574-1576-1578-1580-1582-1584-1586-1588-1590-1592-1594-1596-1598-1600-1602-1604-1606-1608-1610-1612-1614-1616-1618-1620-1622-1624-1626-1628-1630-1632-1634-1636-1638-1640-1642-1644-1646-1648-1650-1652-1654-1656-1658-1660-1662-1664-1666-1668-1670-1672-1674-1676-1678-1680-1682-1684-1686-1688-1690-1692-1694-1696-1698-1700-1702-1704-1706-1708-1710-1712-1714-1716-1718-1720-1722-1724-1726-1728-1730-1732-1734-1736-1738-1740-1742-1744-1746-1748-1750-1752-1754-1756-1758-1760-1762-1764-1766-1768-1770-1772-1774-1776-1778-1780-1782-1784-1786-1788-1790-1792-1794-1796-1798-1800-1802-1804-1806-1808-1810-1812-1814-1816-1818-1820-1822-1824-1826-1828-1830-1832-1834-1836-1838-1840-1842-1844-1846-1848-1850-1852-1854-1856-1858-1860-1862-1864-1866-1868-1870-1872-1874-1876-1878-1880-1882-1884-1886-1888-1890-1892-1894-1896-1898-1900-1902-1904-1906-1908-1910-1912-1914-1916-1918-1920-1922-1924-1926-1928-1930-1932-1934-1936-1938-1940-1942-1944-1946-1948-1950-1952-1954-1956-1958-1960-1962-1964-1966-1968-1970-1972-1974-1976-1978-1980-1982-1984-1986-1988-1990-1992-1994-1996-1998-2000-2002-2004-2006-2008-2010-2012-2014-2016-2018-2020-2022-2024-2026-2028-2030-2032-2034-2036-2038-2040-2042-2044-2046-2048-2050-2052-2054-2056-2058-2060-2062-2064-2066-2068-2070-2072-2074-2076-2078-2080-2082-2084-2086-2088-2090-2092-2094-2096-2098-2100-2102-2104-2106-2108-2110-2112-2114-2116-2118-2120-2122-2124-2126-2128-2130-2132-2134-2136-2138-2140-2142-2144-2146-2148-2150-2152-2154-2156-2158-2160-2162-2164-2166-2168-2170-2172-2174-2176-2178-2180-2182-2184-2186-2188-2190-2192-2194-2196-2198-2200-2202-2204-2206-2208-2210-2212-2214-2216-2218-2220-2222-2224-2226-2228-2230-2232-2234-2236-2238-2240-2242-2244-2246-2248-2250-2252-2254-2256-2258-2260-2262-2264-2266-2268-2270-2272-2274-2276-2278-2280-2282-2284-2286-2288-2290-2292-2294-2296-2298-2300-2302-2304-2306-2308-2310-2312-2314-2316-2318-2320-2322-2324-2326-2328-2330-2332-2334-2336-2338-2340-2342-2344-2346-2348-2350-2352-2354-2356-2358-2360-2362-2364-2366-2368-2370-2372-2374-2376-2378-2380-2382-2384-2386-2388-2390-2392-2394-2396-2398-2400-2402-2404-2406-2408-2410-2412-2414-2416-2418-2420-2422-2424-2426-2428-2430-2432-2434-2436-2438-2440-2442-2444-2446-2448-2450-2452-2454-2456-2458-2460-2462-2464-2466-2468-2470-2472-2474-2476-2478-2480-2482-2484-2486-2488-2490-2492-2494-2496-2498-2500-2502-2504-2506-2508-2510-2512-2514-2516-2518-2520-2522-2524-2526-2528-2530-2532-2534-2536-2538-2540-2542-2544-2546-2548-2550-2552-2554-2556-2558-2560-2562-2564-2566-2568-2570-2572-2574-2576-2578-2580-2582-2584-2586-2588-2590-2592-2594-2596-2598-2600-2602-2604-2606-2608-2610-2612-2614-2616-2618-2620-2622-2624-2626-2628-2630-2632-2634-2636-2638-2640-2642-2644-2646-2648-2650-2652-2654-2656-2658-2660-2662-2664-2666-2668-2670-2672-2674-2676-2678-2680-2682-2684-2686-2688-2690-2692-2694-2696-2698-2700-2702-2704-2706-2708-2710-2712-2714-2716-2718-2720-2722-2724-2726-2728-2730-2732-2734-2736-2738-2740-2742-2744-2746-2748-2750-2752-2754-2756-2758-2760-2762-2764-2766-2768-2770-2772-2774-2776-2778-2780-2782-2784-2786-2788-2790-2792-2794-2796-2798-2800-2802-2804-2806-2808-2810-2812-2814-2816-2818-2820-2822-2824-2826-2828-2830-2832-2834-2836-2838-2840-2842-2844-2846-2848-2850-2852-2854-2856-2858-2860-2862-2864-2866-2868-2870-2872-2874-2876-2878-2880-2882-2884-2886-2888-2890-2892-2894-2896-2898-2900-2902-2904-2906-2908-2910-2912-2914-2916-2918-2920-2922-2924-2926-2928-2930-2932-2934-2936-2938-2940-2942-2944-2946-2948-2950-2952-2954-2956-2958-2960-2962-2964-2966-2968-2970-2972-2974-2976-2978-2980-2982-2984-2986-2988-2990-2992-2994-2996-2998-3000-3002-3004-3006-3008-3010-3012-3014-3016-3018-3020-3022-3024-3026-3028-3030-3032-3034-3036-3038-3040-3042-3044-3046-3048-3050-3052-3054-3056-3058-3060-3062-3064-3066-3068-3070-3072-3074-3076-3078-3080-3082-3084-3086-3088-3090-3092-3094-3096-3098-3100-3102-3104-3106-3108-3110-3112-3114-3116-3118-3120-3122-3124-3126-3128-3130-3132-3134-3136-3138-3140-3142-3144-3146-3148-3150-3152-3154-3156-3158-3160-3162-3164-3166-3168-3170-3172-3174-3176-3178-3180-3182-3184-3186-3188-3190-3192-3194-3196-3198-3200-3202-3204-3206-3208-3210-3212-3214-3216-3218-3220-3222-3224-3226-3228-3230-3232-3234-3236-3238-3240-3242-3244-3246-3248-3250-3252-3254-3256-3258-3260-3262-3264-3266-3268-3270-3272-3274-3276-3278-3280-3282-3284-3286-3288-3290-3292-3294-3296-3298-3300-3302-3304-3306-3308-3310-3312-3314-3316-3318-3320-3322-3324-3326-3328-3330-3332-3334-3336-3338-3340-3342-3344-3346-3348-3350-3352-3354-3356-3358-3360-3362-3364-3366-3368-3370-3372-3374-3376-3378-3380-3382-3384-3386-3388-3390-3392-3394-3396-3398-3400-3402-3404-3406-3408-3410-3412-3414-3416-3418-3420-3422-3424-3426-3428-3430-3432-3434-3436-3438-3440-3442-3444-3446-3448-3450-3452-3454-3456-3458-3460-3462-3464-3466-3468-3470-3472-3474-3476-3478-3480-3482-3484-3486-3488-3490-3492-3494-3496-3498-3500-3502-3504-3506-3508-3510-3512-3514-3516-3518-3520-3522-3524-3526-3528-3530-3532-3534-3536-3538-3540-3542-3544-3546-3548-3550-3552-3554-3556-3558-3560-3562-3564-3566-3568-3570-3572-3574-3576-3578-3580-3582-3584-3586-3588-3590-3592-3594-3596-3598-3600-3602-3604-3606-3608-3610-3612-3614-3616-3618-3620-3622-3624-3626-3628-3630-3632-3634-3636-3638-3640-3642-3644-3646-3648-3650-3652-3654-3656-3658-3660-3662-3664-3666-3668-3670-3672-3674-3676-3678-3680-3682-3684-3686-3688-3690-3692-3694-3696-3698-3700-3702-3704-3706-3708-3710-3712-3714-3716-3718-3720-3722-3724-3726-3728-3730-3732-3734-3736-3738-3740-3742-3744-3746-3748-3750-3752-3754-3756-3758-3760-3762-3764-3766-3768-3770-3772-3774-3776-3778-3780-3782-3784-3786-3788-3790-3792-3794-3796-3798-3800-3802-3804-3806-3808-3810-3812-3814-3816-3818-3820-3822-3824-3826-3828-3830-3832-3834-3836-3838-3840-3842-3844-3846-3848-3850-3852-3854-3856-3858-3860-3862-3864-3866-3868-3870-3872-3874-3876-3878-3880-3882-3884-3886-3888-3890-3892-3894-3896-3898-3900-3902-3904-3906-3908-3910-3912-3914-3916-3918-3920-3922-3924-3926-3928-3930-3932-3934-3936-3938-3940-3942-3944-3946-3948-3950-3952-3954-3956-3958-3960-3962-3964-3966-3968-3970-3972-3974-3976-3978-3980-3982-3984-3986-3988-3990-3992-3994-3996-3998-4000-4002-4004-4006-4008-4010-4012-4014-4016-4018-4020-4022-4024-4026-4028-4030-4032-4034-4036-4038-4040-4042-4044-4046-4048-4050-4052-4054-4056-4058-4060-4062-4064-4066-4068-4070-4072-4074-4076-4078-4080-4082-4084-4086-4088-4090-4092-4094-4096-4098-4100-4102-4104-4106-4108-4110-4112-4114-4116-4118-4120-4122-4124-4126-4128-4130-4132-4134-4136-4138-4140-4142-4144-4146-4148-4150-4152-4154-4156-4158-4160-4162-4164-4166-4168-4170-4172-4174-4176-4178-4180-4182-4184-4186-4188-4190-4192-4194-4196-4198-4200-4202-4204-4206-4208-4210-4212-4214-4216-4218-4220-4222-4224-4226-4228-4230-4232-4234-4236-4238-4240-4242-



## The Home Workshop

### Underslinging a Ford Speedster

(Continued from page 122)

racier appearance, steadies the car, and allows the wheels to hug the road when making turns at high speeds. In the accompanying illustration a method of accomplishing all this is shown.

The supports for lowering the rear spring are made from  $\frac{1}{2}$ -in. plate, rectangular in shape and drilled each end. A rod at each side passes through the plates. One end of the rod is fastened to the regular spring hanger; the other extends to the radius rod, where it is held as shown.

When the spring is placed in the lower position, it is necessary to use angle plates as a support in the center.

The lowering at the front of the frame is accomplished by moving the axle forward and making a bracket of rectangular section, with two holes drilled through each, to support the spring. The forward hole of each bracket is engaged by a bolt through the axle where the spring perch previously was located. The rear hole is used for fastening the spring perch above the bracket and the radius rod below the bracket as detailed.

The moving of the front axle forward also lengthens the wheel base. This is desirable, as it increases the steadiness with which the car holds the road.

In fitting the forward bracket, the builder should make the upstanding lip, shown on the bracket, bear against the axle. This is to insure perfect lateral rigidity of the front axle. Inexpensive front radius rod braces are obtainable, their use depending upon the distance the spring is moved to the rear.

### Reforging Front Axle Lowers Car's Center of Gravity



ONE ingenious amateur mechanic who was converting his light car into a speedster, lowered the center of gravity several inches by having the front axle reforged as shown. This was accomplished without altering any essential details or the steering method.

### Remodeled "Flivver" Does 94 Miles an Hour on Beach



WHAT a remodeled Ford can do was shown when this car ran at 94 miles an hour on Muswai Beach, New Zealand. It is owned by Stanley and Ivan Andrew, of Auckland.



**Sure  
I'll Fix It!**

NOTHING could be simpler with these Klein Piers. Fact is, I'm glad to get my hands on them again. I guess every man feels that way about good tools.

Yes sir, most men do feel that way. That's one reason why Klein Piers have been the favorites for 68 years. You'll notice that most hardware stores feature them. Electrical companies specify them! Treat yourself to a pair today.

Mathias **KLEIN** & Sons  
Established 1867 Chicago 1898

Good tubes  
for a  
good set

**DID** you ever look the tube question square in the face? Ever stop to realize that the vacuum tube will make or break your receiving set as far as good results are concerned? Give your set a fair chance to bring in the distant programs. Resolve now that a good set deserves good tubes and decide on MAGNATRONs. The results will pleasantly surprise you.

MAGNATRONs know no superiors. And yet the MAGNATRON DC-201A, the MAGNATRON DC-199, and the MAGNATRON DC-199 with large base sell for only \$3 each, at your dealer's.

Connewey Electric Laboratories  
New York, N. Y. Manufacturers

# MAGNATRONs





## We've mapped the air for Radio explorers!

Get your copy of this great new map to-day

**T**WIST the dial until you catch a faint hum. Tune it carefully and it becomes a murmur of distant music. Then a moment of silence. "This is station KFAF, Denver"—and you add another station to your list.

But how far away was it? What sort of country did the message flash over? You want to visualize your exploit and mark it for future reference.

You can—with the New Collier Radio Map of the United States and Canada. It's beautifully printed in three colors. Every station is clearly marked and the time zones outlined.

Instantly you can tell how many miles away a station is. Cut out the scale of miles provided and paste it on cardboard. Put a pin through one end at the point where you are located. Swing the other end across the country until you reach the station you are after.

Here are some more points worth noting:

1. If you use a directional aerial, you can pick out any station you want to get on the map, and point the loop towards the exact point where the station is located.
2. Around the map there is an alphabetical list of all stations which also gives the name of the operator of each. If you miss the letters given by an announcer, you often catch the name of the operator of a station which can then be located by referring to the index.
3. The map outlines the boundaries of the radio districts, identifying them by number. This will be a help in locating amateur stations.

There's a lot of satisfaction in radio exploring with this great new map. And it costs only a quarter. Get your copy at your newsstand, bookstore or radio dealer's thought. Or just mail 25c in coin or stamps with your name and address to us direct.

**P. F. COLLIER & SON CO.**  
Dept. R.M. 250 Park Avenue  
NEW YORK CITY

## The Shipshape Home



### Repairing a Porch Column

THE high cost of lumber has led to the use of much wood for the exterior woodwork of modern houses that does not last very well. For that reason the home worker often finds it necessary to repair porch steps as described last month, or even to replace porch columns.

If a column has rotted away at the bottom, break off a piece of the base molding and base block to allow you to measure the exact size of the block and the diameter of the column. Also find the length of the new base and short length of column required to replace the decayed portion.

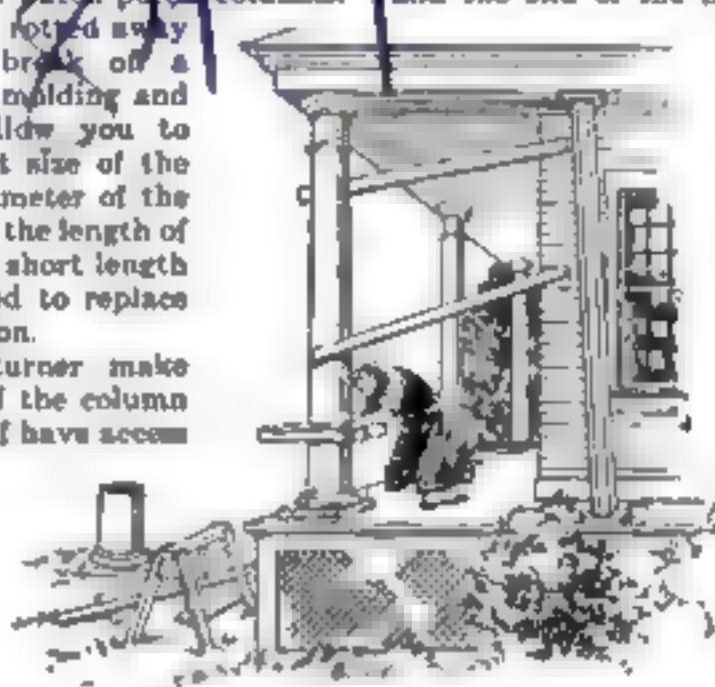
Have a woodturner make the new section of the column unless you yourself have access to a lathe large enough for the work. Be careful to have it made a trifle larger rather than a smaller than the old. If it should be smaller, a neat repair could not be made, but if it is a trifle larger, it is easy to pare and sandpaper the joint down and make a workmanlike job. It will be necessary to prop up the porch roof with a strut, as illustrated, to take the weight off the column. One or two braces may be nailed from the house

the column to keep it plumb when it is being cut.

Measure exactly the combined height of the base block and short length of column and mark where the old column is to be cut. Nail on the column two strips to guide the saw, as shown; they must be quite level. If your saw is sharp and fine and the end of the new piece of post is

turned true, the joint should require no fitting. The base block, however, will have to be fitted to the bevel of the porch floor, although this may be but a trifle.

Repair the porch floor under the column, if decayed, and paint all joints before putting the new work in place. Only a few wire finishing nails are required to hold the new base in place.—A. E. E.



Sawing out the decayed base of a porch column before inserting a new piece

When a stone or sharpening steel is not at hand, a knife may be brought to a keen edge by drawing it over the back or upper edge of a hacksaw. The hacksaw blade, which should be of the common type that is hardened throughout, must be held taut in its frame.—T. G. L.

### Holder for Razor Blades

NOT the least of the many small and sometimes annoying problems met by a busy housewife is to find a safe way to dispose of used razor blades. She does not throw them away for fear the feet may find them. From latter experience I found it unsafe to put them in the trash to be burned.

Nearly at my wit's end, I finally thought of cutting a slit large enough to admit a blade in the top of a used evaporated-milk can. The sharp edges are turned in and the can is enameled white. Once inside, the blades are beyond causing an accident. —MARGARET CRAGO, Louisville, Ky.

### Renewing Pump-Valves

FIVE years ago a pump used in connection with a rather deep cistern failed to raise water. I found the leather valves were worn out.

Having to make a temporary repair at once, I peeled three layers from the inside of an old auto tire, placed them under a weight overnight to flatten them out, and the next morning made valves from them. They are doing service yet. The service they have given already is more than might be expected from the best quality of leather valves, so that this type of repair can be recommended, especially

as pumps often give out at a time when it is impossible to wait for regular valves. —F. X. ALLEN, Del Rio, Tex.





## The Shipshape Home

### Table-Leaf Closet

ONE great aid in keeping a home shipshape is a convenient place to store away the extra leaf or leaves for the dining-room table. A closet for this purpose usually can be built into the wall in the kitchen entry, hallway, or elsewhere. To make such a closet, find out by tapping the plaster or wallboard where the



of the studs or upright supports are located and then cut out the wall between them from the baseboard up to a height 1 in. more than the length of the table leaves. Make a rectangular box to fit the opening, using  $\frac{3}{4}$ -in. sides and ends and a sheet of iron or tin for the back. Nail this in place in the opening and finish either with trim to match the other woodwork in the room, or with any small molding that is at hand or can be obtained easily.

The table leaves are held in place in the cupboard by dropping a rod with two down-turned ends into screweyes placed in each side of the cupboard.—T. F. WAIT, Storm Lake, Ia.

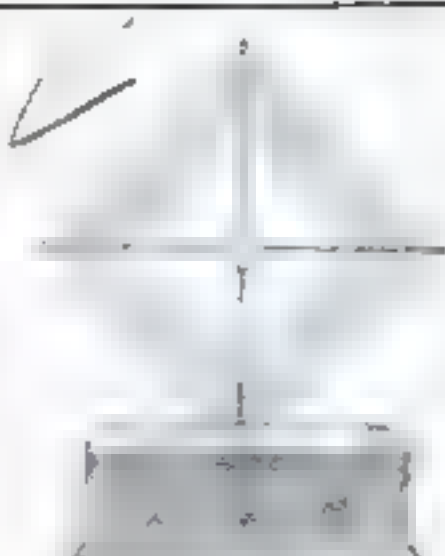
### Paste for Stopping Leaks

A PUTTY-LIKE mixture of oxide of iron, coal tar, and boiled linseed oil may be used in repairing leaky gutters, water tanks, iceboxes, and the like. Several layers of cloth strips coated with this mixture make a good emergency substitute for a soldered sheet-metal patch.

### Dollars for Ideas

IN KEEPING your home shipshape, you often hit upon ingenious, time-saving, labor-saving and money-saving ideas.

If you will describe, in not more than 200 words, each of your ingenious keeping-the-home-shipshape methods, we will pay \$2 for every one published. Include a pencil sketch or photograph to illustrate the idea, if possible, and address your letter to the Home Workshop Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York.



A set anyone can put together and enjoy all-the-year-'round radio



Directions given so simply that anyone can follow them

ABOVE are illustrated the circular of printed instructions and the life-size diagrams of the wiring, which are packed with each Model "S" Kitset. Step by step the making of the set is described in clear simple language—yet simple operations which anyone can easily follow.



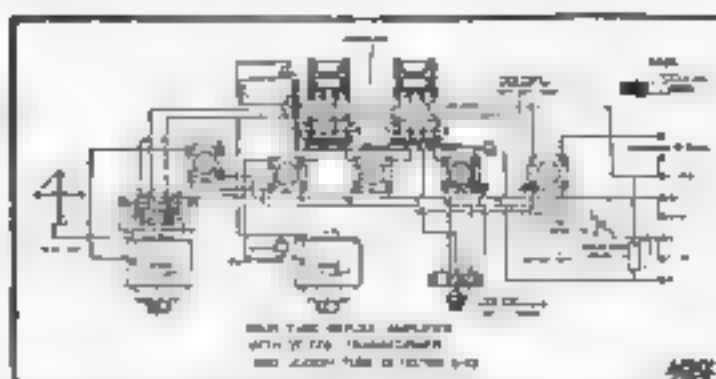
Only two tools required—a screwdriver and pliers—and they are included in the kit.

### Enthusiastic praise from Model "S" user

From Hartford, Conn.: Just finished it tonight. It's a wonder. Finest we ever heard. Congratulations for your wonderful engineering.

# ACME

~ for amplification



This is the new Model "S" Acmeflex Kitset

IN THE above wiring diagram special attention is called to the D-Coil radio frequency tuning unit and the vacuum tube detector, giving the famous Acme Reflex (trademark) still greater distance, greater selectivity and better reception.

## We can save you about \$60.00 on this \$150.00 radio

IF YOU bought this set completely assembled it would cost you \$150. But by putting it together yourself you can buy it for only \$80, plus cabinet, saving about \$60. We could make it for less but it wouldn't give results.

Acme Engineers have done all the engineering for you and have written clear, simple directions which show you, step by step, how to put the set together. Many have done it in three hours, and found it fascinating fun. Even if you know nothing about radio you can put it together. All the parts are in the kitset, even the loop. No antenna to erect. Even a screwdriver and pair of pliers, the only tools you need, are included. No soldering to do. The panel is all drilled for you. The only accessories to buy are tubes, batteries, loudspeaker and cabinet.

And the finished set is the famous Acme Reflex (trademark) now wonderfully improved in distance, selectivity and reception. It will put in distant stations loud and clear on a loop and loud speaker. Compare results with other sets of six to eight tubes. Only one tuning dial—easy to tune. Send coupon today for complete information. Lots of amateurs have built up a nice business putting together three sets for their friends.

### Note these features of Model "S" Acmeflex Kitset

Complete directions given for putting set together. No antenna to erect. No technical knowledge or workshop required. Only two tools and they are in the kit. No soldering to do. Only one tuning dial. Excellent reproduction. Greater distance, selectivity and selectivity. Non-radiating won't bother your neighbor. Saves you about \$60.00.

ACME APPARATUS COMPANY  
Dept. P-1, Cambridge, Mass.  
Former Radio and Transformer Engineers and Manufacturers

ACME APPARATUS COMPANY  
Dept. P-1, Cambridge, Mass.  
Send complete information about the new Model "S" Acmeflex Kitset to:  
Name \_\_\_\_\_  
Street \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_

THE NEW IMPROVED INKOGRAPH SELF FILLER

GREATEST VALUE EVER OFFERED

The Perfect Writing Instrument

Writes with ink that lasts up to 100,000 words with one fill.

Makes 3 or 4 Carbon Copies with Original Ink.

Patent Automatic 14kt. gold feed

SEND NO MONEY

IN KOGRA PH CO., Inc. 123-72 Centre St., New York

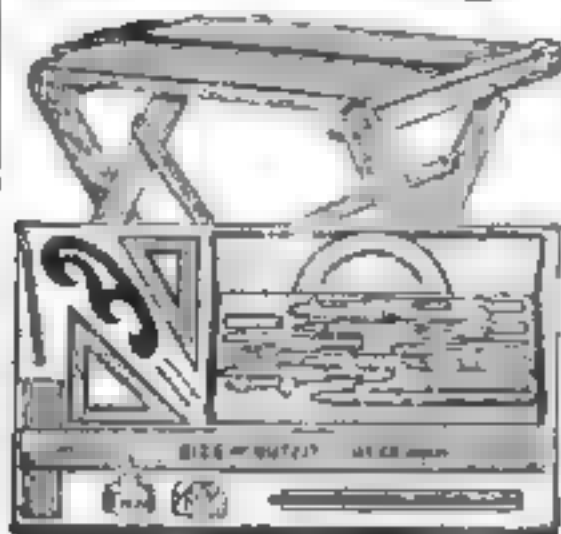
ACTUAL SIZE 6" LONG

THE WRITING HONORABLE

THEIR HAND WRITING COULD BE REPRODUCED ON PAPER AND MAKE PERFECT COPIES OF ANY DOCUMENTS WITH ONE FILL OF INK.



## All These Included No Extra Charge



### Mail Coupon Below

Complete Set of Drawing Instruments sent as soon as you enroll. You get a 20x25 inch drawing board, a 24-inch T square, a 12-inch rule, a supply of drawing paper, two triangles, a French curve, pencils, erasers and thumb tacks. They would cost approximately \$25.00 at any retail store but I include them in my course without extra charge.

### The Trained Draftsman Earns a Good Salary

There is always a demand for skilled draftsmen. Companies are issuing calls every day for men to fill positions paying good salaries. Work is high, pleasant and profitable; a trained draftsman can be reasonably sure of having a good job all the time.



### I Guarantee

to train you on practical work under personal supervision until competent as a regular draftsman, and guarantee, further, to furnish you with draftsman's complete working outfit, a special "Chief's Own" drafting table, and all the instruments you need, just as soon as you become my student—all to be included in the course without extra charge.

### Practical Training Good Salaries

I am a practical Chief Draftsman. I have been doing drafting work for a quarter of a century and I know just the kind of training that is demanded from men who get big salaries. I train you by giving you actual, practical work, the kind you must be able to do to hold a permanent position.

### You May \$90 Drafting Earn a Course

In addition to my other offers, I have made arrangements whereby you may earn a regular \$90 drafting course while you are my student. I want to do everything possible to prepare draftsmen for the urgent calls now being made for them, by offering every independent to ambitious men anxious to succeed in a big way. Big companies issue calls every day for skilled draftsmen to fill good paying positions. A trained man can be reasonably sure of a good job all the time. He can expect a good salary by extremely well paying hours work. Write for details.

Chief Draftsman Dobe, Div. 12-64  
1951 Lawrence Ave., Chicago, Illinois

Without any obligation on the student's part, please mail your book. "Successful Draftsmanship" and full particulars of your liberal Personal Instruction offer to a few students. Book is to be sent free and prepaid.

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

Post Office \_\_\_\_\_ State \_\_\_\_\_

## Better Shop Methods

(Continued from page 88)

### Using an Electric Drill in a Planer

*A portable tool is clamped to the clapper block to do the work of a big radial drill*

By William G. J. Thompson

RECENTLY in the shop where I am employed, a 1200-lb. cast-iron roll about 6 in. in diameter and 10 ft 6 in. long, had to be drilled. It had 16 grooves, in each of which 15 holes were to be drilled and tapped. If a radial drill and chain block had been available, this might not have been much of a problem, but all the regular drill presses were in such a position that a chain block could not be hung in a convenient place to take the weight of the casting.

The foreman was about ready to use one of the drill presses and about 6 or 8 men to move the roll, when I thought of adapting a big planer as a drill press.

Getting an electric drill from the tool crib, I found that I could unscrew one of the handles and make a holder for the drill that could be clamped in the planer. The foreman, when he heard my suggestion, told me to do whatever was necessary.

I obtained a piece of 1½-in.-square stock 9 in. long, and had the blacksmith bend it to form a right angle, one leg 7½ in. long and the other leg 1½ in. I centered the short end and turned and threaded it to fit the tapped hole in the

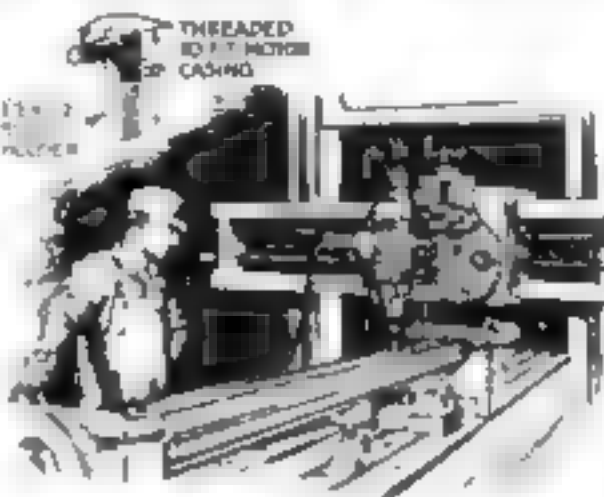
drill motor casing. Then I screwed the holder into the casing and, finding it was not in line with the drill, I squared off the shoulder of the holder until it was exactly parallel to the motor.

After clamping it to the clapper block of the planer, I found that when the drill was fed into the work, the clapper block would swing out because the drill was ahead of the center of the clapper box.

To overcome this difficulty, I locked the clapper block in the clapper box by drilling a hole in the clapper box and tapping it for a set-screw. I spotted the clapper block with the drill point to allow the set-screw point to hold firmly.

Then I set the drill up and shimmed it until it was perfectly straight both ways. I locked the clapper block with

the setscrew and moved the planer until the first hole was in line with the point of the drill. After drilling this hole, I indexed the next groove and drilled the second hole, continuing until the first row of holes had been drilled around the roll. Then I moved to the second row of holes and did likewise until the entire 185 holes were drilled. The saving of time and money was considerably over any other method that might have been used.

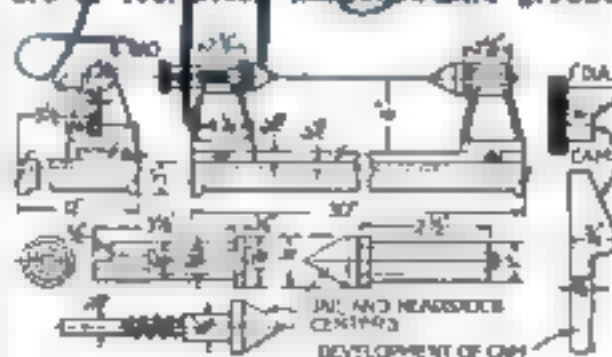


Drilling a large grooved roll with a portable electric drill fastened in a planer

### Bench Testing Centers

THE bench centers shown below are designed for use in the toolroom for laying out and testing work. The tool can be made at small expense.

The bases of cast iron and the centers are of tool steel, hardened and ground.



Details of the centers. One pattern serves for both headstock and tailstock castings

One pattern will do for both the headstock and tailstock castings.

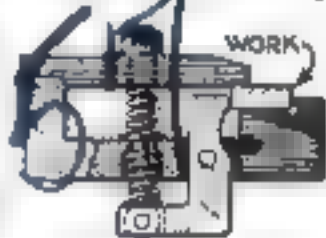
The slideway runs the entire length of the base. The tailstock and headstock, each of which is provided with a gib, can be set quickly any distance apart and held with thumbcrews.

All of the machine work should be done carefully, and for very accurate work the top surface of the base should be scraped. Both centers should be exactly the same height and precisely parallel with the slide and top of base.

A cam withdraws the tail center from the work with a half turn to the right. A coiled spring returns the center to its position with another half turn of the knurled handle.

### Double-Acting Machine Clamp

FOR machining a large number of straight edges ½ by 1½ by 24 in., the writer had a double-acting clamping fixture made as shown.



The work-holding casting is 25 in. long, provided with one clamp at the center and two others about 3 in. from each end. Much hard work in setting and blocking up often can be saved by the use of a clamp of this kind.—F. N. C.



## Better Shop Methods

### Old Bill Says—

SOME of our customers will spend \$100 repairing an old machine that is worth only \$10 as junk.

What economy is there in repairing worn or broken parts of an old machine that can be replaced by a new one for the same or, as often happens, less cost?

Be sure to use a handle on a file when filing in a lathe.

To be a good mechanic requires a constant struggle against slipshod methods, but half the battle is to have plenty of enthusiasm for work.

Vinegar is a wonderful help in loosening a rusted screw.

When you knock your shop, you knock yourself. If things never are going to suit you, why not get out?

When using a toolpost grinder, always protect the ways and bearings from grit by spreading an old newspaper or cloth under the wheel.

### How to Draw Accurate Freehand Circles on Shop Sketches



EVEN experienced draftsmen often make sadly misshaped circles on their freehand sketches. They are especially apt to do so when they go into the shop to draw details, because usually they have not their drafting instruments.

Circles can be drawn quite easily, however, without any other aids than the sketch pad and the pencil. Tear off a strip of paper a little longer than the radius of the circle and on it check two points to limit the center and circumference to be drawn. Hold one point on the center and mark several points at intervals around the circumference as shown. With these guides the circle can be filled in accurately.—FRANK W. BENTLEY.



Old Bill machine shop foreman

# BARBERING

## Now One of the Highest Paid Professions!

**'90 to '150 Every Week!**

**BE A "WHITE-COLLAR" MAN—  
Earn \$30 to \$150 a Week—CLEAN Money!**

What's the use of doing dirty, greasy, hard work, when you can NOW make TWICE as much money in a manly profession that is CLEAN, profitable and full of opportunities?

**Easy to Learn—  
Quick to Earn!**

That's BARBERING for YOU! And the best part of it all is this—scientific barbering, as taught the modern MOLER way, makes YOU a Master Barber in a short course of intensive training, at small expense! You soon step out as your own Boss, if you wish, in your own Shop, which we will gladly help you equip.

**See the World,  
Tool**

Or, if you prefer, we will help you step into a real job, with good pay the first day, after you graduate. Ocean Liners, crack trans-continental passenger trains, big luxurious hotels and skyscrapers all over the world, as well as thousands of Barber Shops everywhere, demand MOLER trained men.

**MOLER Graduates  
Are Always Busy!**

MOLER trained Men are always given the preference, for they alone possess the valuable, thorough MOLER training in the application of all the latest scientific Barbering methods including the Electric hair cutter, the mechanical massage, and the latest vacuum in ladies' hair brushing. MOLER also gives special training in ladies' manicuring and an easy practical course in the treatment of skin diseases.

**Earn While  
Learning!**

"Where there's a Will there's a Way" to earn BIG pay! Write to the nearest MOLER College, there is one near you and learn how you can earn while you learn the barber trade. Ask for the new FREE MOLER Barbering Booklet C. Find out HOW MOLER helps you help yourself AFTER you graduate, as well as BEFORE! Find out why MOLER Men are making DOUBLE the money others made just years before Ladies Shingle Bobbing became so popular. You're NEXT in line for big pay—the MOLER way. Send Coupon TODAY!

**MOLER SYSTEM OF COLLEGES**  
30 Branches in United States and Canada

New York, N. Y.  
Chicago, Ill.  
St. Louis, Mo.  
Kansas City, Mo.  
Cincinnati, Ohio

Cleveland, Ohio  
Detroit, Mich.  
Denver, Colo.  
Omaha, Neb.  
Milwaukee, Wis.  
New Orleans, La.

Atlanta, Ga.  
Memphis, Tenn.  
Dallas, Tex.  
Houston, Tex.  
San Antonio, Tex.

**THIS?**



**and  
THIS!**



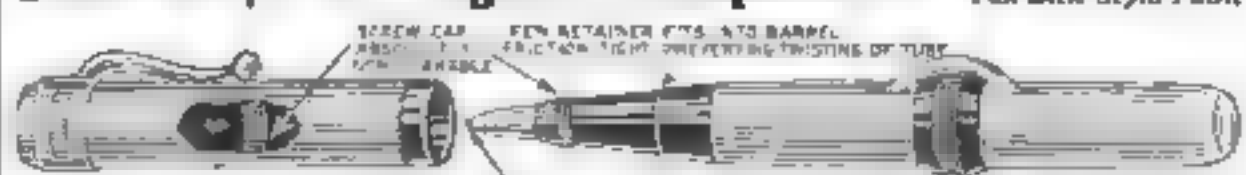
**MOLER SYSTEM OF COLLEGES**  
Address Nearest Branch  
(Street Address NOT Needed)  
Please send me without obligation on my part your Booklet C.  
Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_

**\$25.00 in PRIZES**

See top of page 8 in front of book for details

**Sells for \$1.25. Agent's Sample 65c.!**

New Self-Filling Bamboo Fountain Pen with Stylus Point



ITS THE POINT. HAS EIGHT GROOVES FOR INK TO FEED  
Imported from Japan. "It makes Carbon Copies." Guaranteed for 1 year. For less Making \$20 Daily!  
Money refunded if you don't think it's the best pen you ever wrote with. 10¢ a pen for Profit. Send for quantity price list and distributing plan. F. SPORS & CO., 200 S. 4th St., Lacrosse, Wis., Minnesota







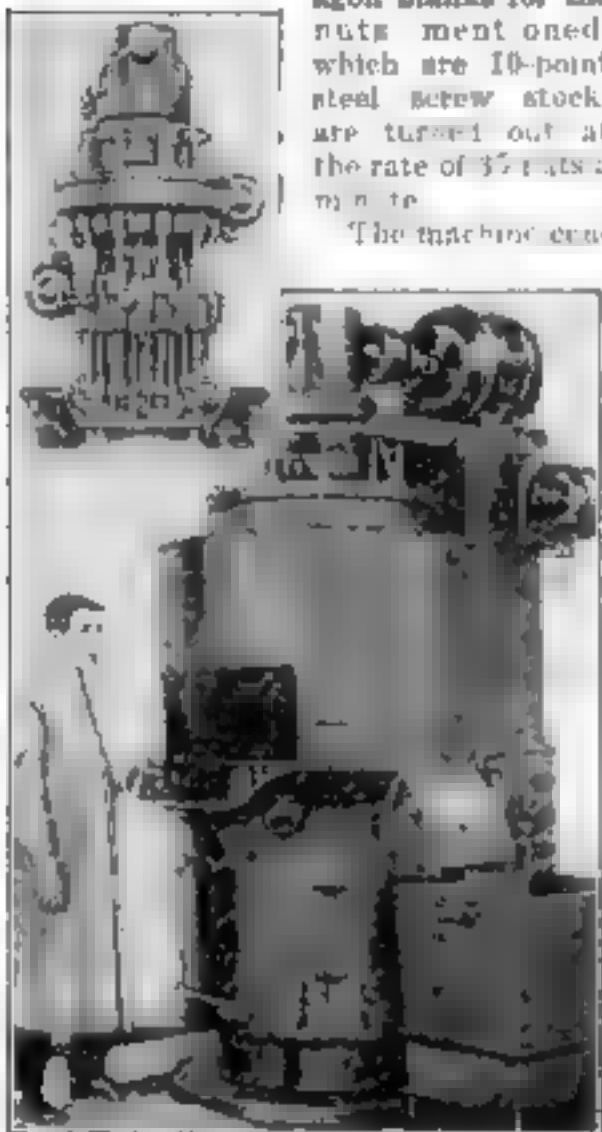
## Better Shop Methods

### New 10-Spindle Drilling Machine Operates Continuously

THE new 10-spindle continuous rotary drilling machine illustrated was designed and built for drilling holes  $\frac{1}{2}$  in. in diameter and 1 in. deep in collar hexagon nuts used on automobile disk wheels. It is adaptable, however, for drilling other parts of a similar kind.

Machinists used to an ordinary drill press will be particularly interested in this machine because of the amount of work it handles. The cold pressed hexagon blanks for the nuts mentioned, which are 10-point steel screw stock, are turned out at the rate of 35 nuts a minute.

The machine con-



The operator merely has to slip a blank into each work-holding fixture as it passes by.

sists of a stationary round post mounted on a base. A circular carrier supports 10 drilling spindles with their respective work tables and actuating mechanism, all of which revolve around the base.

The cutting feed to the work table is obtained by a cam mechanism tuned to give the operator an opportunity to load. The feeding and holding of the nuts is automatic. All the operator has to do is to slide a blank nut approximately into position in each of the fixtures as it passes by. The ejecting of the nuts is automatic.

### Copper Tool Used as Indicator

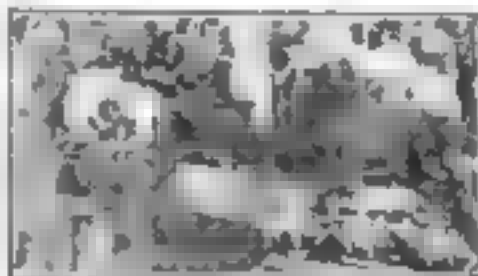
IN TRUING up pulleys, shafts, studs, or other finished work in a lathe when no indicator is available, a copper tool may be used. The tool should be ground to a diamond point.

Insert the tool or tool holder in the tool rest and run the copper point against the revolving work until it touches the high spot. Then adjust the work until it shows a copperish line of even width all around. W. J. T.



You've long wanted to come to this Million Dollar School, the World's Largest Automotive and Electrical School at Kansas City, Mo. NOW IT WILL BE EASY because of my big reduction in cost of tuition. I've raised the salaries of thousands of other fellows—I can do it for you, and if you decide now to come here, spend a few weeks in actual "Learn by Doing" training, there's a good job paying big money ready for you or a chance to go into business for yourself. But, you'll have to decide NOW to be sure of the big saving in cost of training.

E. J. SWEENEY, President.



Auto Mechanic 100 Weeks and Up

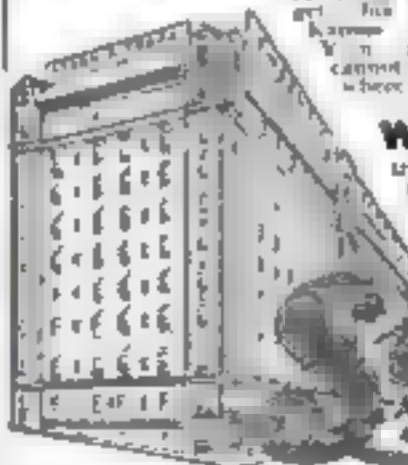
### Learn a Good Trade

One that will pay you \$200 to \$300 a month and more. Get in the largest business in the world—the Automotive Business. I want to prove that you can do what thousands of men just in your position have done as a result of SWEENEY TRAINING. I will take up the \$100 HIGHEST \$500 NOW. Learn it at SWEENEY'S. Know a Guy? A true while you can get the big saving in tuition.

### Get the Best for Less Money

The SWEENEY AUTO SCHOOL offers you the greatest opportunity you ever had. A big reduction in tuition, a Million Dollar business, 100 of the highest wages in the world, all are yours at the Sweeney School of Practical Instruction. And every instruction—just across the street from the Union Station, a short distance from the beautiful new Two Million Dollar Municipal Building. BUT REMEMBER, THERE'S ONLY ONE SWEENEY AUTO SCHOOL. THERE'S ONLY ONE SWEENEY SYSTEM.

Learn and you can only get the system at Kansas City, Mo. You must try it, you cannot get it any where else.



### WRITE ME TODAY

or wire me when you'll be here. Don't miss the chance to learn the right way. Sweeney trained men in demand everywhere. \$200 to \$300 a month and more. You must decide now to get the best of the big reduction in tuition. Write for my big FREE 66 page book or wire me you are coming. No colored students accepted.

E. J. SWEENEY, Pres.

### LEARN A TRADE

**Sweeney**  
AUTOMOTIVE ELECTRICAL SCHOOL  
409 SWEENEY BLVD. KANSAS CITY, MO.

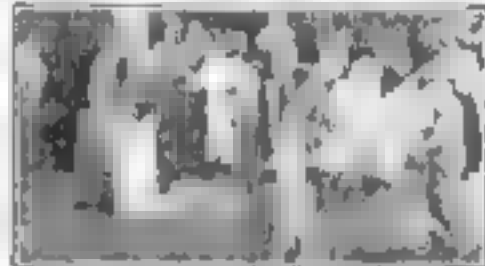
There's Only One  
Sweeney School.  
It's at Kansas  
City, Mo.

And Now **1/2** So You Can  
Cuts The Tuition Start Your  
Training At Once  
There's Only One Sweeney School  
It's at Kansas City, Mo.

**COME RIGHT NOW.** This is the most amazing offer ever made. If you are mechanically minded, if you like to work with tools, you will learn under the "Sweeney System" by actually doing the work everything about all kinds of automobiles, oxy-acetylene welding, vulcanizing, battery work, electrical work, building and repairing Radio sets. No experience or education needed. No books are used. You work on actual complete gas engine and electrical equipment in an actual in the world. Over \$100,000 invested. \$40,000 Radio Station WHE. You'll get dirty and greasy, but you'll learn by the "Sweeney System" that fits you for the big pay jobs at \$50 a week and up, waiting for Sweeney trained men.

### Sweeney System OF PRACTICAL INSTRUCTION

There's only one place where you can get this training—It's at the world famous Sweeney Automotive and Electrical School of Kansas City. It's the only and Sweeney School, the largest in the world. There's only one Sweeney System. No other school offers you can give you this training that not only trains you to fill big paying jobs but also gives you time and money. This training is a winning big money skill. 100 Sweeney C students estimate 70,000 of the most over 4 per cent paying last year.



Battery Experts 1000 Month and Up

### My Free Book Tells You

How to get a good mechanical job.  
How to learn to be a chauffeur or truck driver.  
How to learn to repair any make of car.  
How to learn to make batteries and auto fires.  
How to weld.  
How to run a garage successfully.  
Shows you hundreds of actual photographs of men at work in my big shops.  
Shows how 40,000 men got their start. Shows how easy it is to learn several good trades. How much fun you have during recreation hours, swimming pool, entertainment, food and orchestra, radio broadcasting Station WHE.  
Answers every question.  
66 pages beautifully illustrated.



## INVENTORS PROTECT YOUR IDEAS

Send for our Guide Book, HOW TO GET A PATENT, and Evidence of Invention Blank, sent Free on request. Tells our terms, methods, etc. Send model or sketch and description of your invention for our Instructions. No Charge for the Above Information.

**RANDOLPH & CO.**  
Dept. 130, Washington, D. C.

NAME.....  
STREET.....  
CITY..... STATE.....







## NOTHING BUT THE TRUTH

Reports that the famous Polyplug infringes existing patents owned by a competitor are absolutely without foundation in the opinion of competent counsel who have minutely investigated the situation.

The manufacture and sale of Polyplug will be continued, and the quality and merit of Polyplug will continue to keep it far in the lead of a host of inferior plugs.

These features have made Polyplug the envied leader of its field.

## POLY PLUG



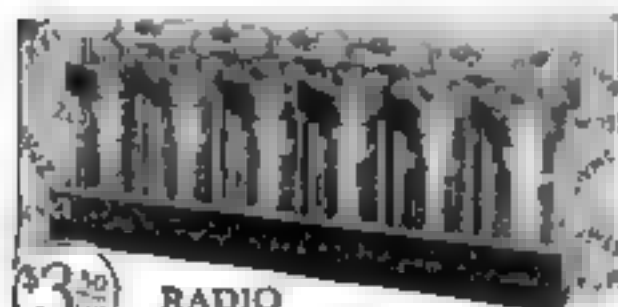
75¢

Positive Permanent Contact. No screws or trick parts. Wires quickly and easily attached—pulling and jarring cannot loosen contact. Instantaneous changing from headphones to speaker. Made of genuine Bakelite. Send for Circular H.

POLYMET

Manufacturing Corp.

70-74 Lafayette St., New York



\$3.30

## RADIO Storage "B" Battery

Lasts Indefinitely—Pays for itself

Economy and performance unheard of before. Recharged at a negligible cost. Approved and listed as Standard by leading Radio Authorities, including P. M. S. Laboratories, Inc. For last 100,000 hours. Never fails. Larger size and other types available. Equipped with special holder case, in which the battery can be held in place. Battery holder glass jar. Heavy rubber lining. (Order yours today!)

**SEND NO MONEY** Just send number of batteries you want. We will ship them to you. No money down. Pay a nominal amount when the batteries are delivered. 5 per cent discount for cash with order. (Mail your order now!)

WORLD BATTERY COMPANY

2210 So. Wabash Ave., Dept. 80, Chicago, Ill.  
Makers of the famous World Radio Storage Battery.  
Phone 4-1111. (In New York City, 110 Ave. 21st St., Phone 4-1111. All equipment with latest holder case.)

**World** FOR **RADIO**  
STORAGE BATTERIES

## Your Tires Free and \$300 a month



15,000

## Agent Users Wanted

SEE how easy it is with the MASTER SALESMAN KIT, which I send Free, to make \$10 to \$15 a day in your spare time showing MELLINGER TIRES at his savings to car owners. This powerful, hand-made, over-size, non-skid Cord is guaranteed by Road for mileage half way around the world.

The Melling Plan starts you in business, all or part time, no capital or experience needed. Tires shipped prepaid on approval. Lowest wholesale prices in America.

**FREE** If you will boost MELLINGER TIRES, I have a surprising offer that will give you a lot of spare time. Be first to get my Free Kit, containing everything you need to start your business. Simply send your card to nearest address. S. L. MELLINGER, Pres.

MELLINGER TIRE & RUBBER CO., Philadelphia, Pa. Dept. 1228, Kansas City, Mo.

## Better Shop Methods

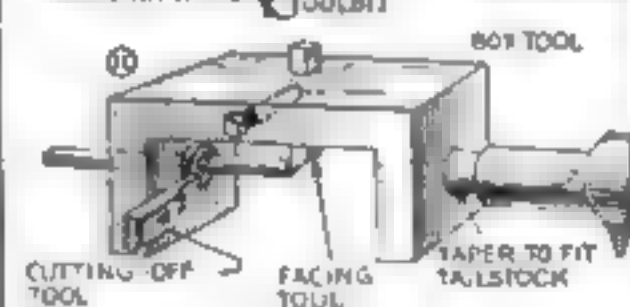
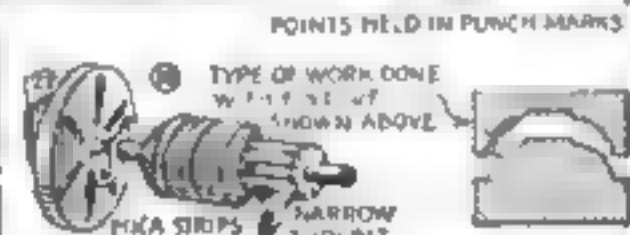
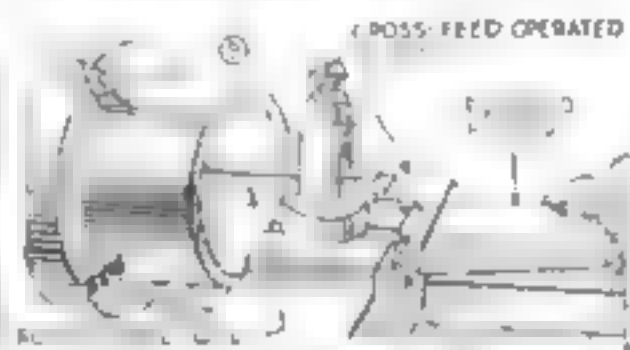
### Lathe Shortcuts that Save a Machinist's Time

(Continued from page 130)

tance between centers, is machined with the center in place in the usual way and driven with the chuck.

When this is completed, remove the tailstock spindle and insert the bushing, which is to be used as a steady rest bearing, and center. Move the screw or shaft along through this bushing and through the hollow spindle of the headstock for a sufficient distance to allow another section to be turned. If a thread is being cut, leave enough of the thread remain on the bushing to start the new cut. The operation is repeated as necessary.

In cutting a square or screw thread, a great deal of time may be saved by the



Turning a spherical surface, using a cam-outlet, and using a box tool for small pins.

use of two tools. First, rough out the thread with a tool that is 1/32 to 1/16 in. narrower than the finished size of thread. Then follow with the finishing tool. This method avoids tool breakage and stopping to grind the tool, as very little stock is left for the finishing tool to remove. It also speeds up the work noticeably.

The tool shown in Fig. 2 leaves an excellent finish when turning long shafts with a light cut and coarse feed; practically no filing will be necessary. Grind the cutting edge as for regular square-nosed finishing tools. If water is allowed to drip on the point of tool while in use, the finish will be improved, but the work should be smeared with oil afterwards to prevent rust.

Another style of tool suitable for finishing heavy shafts and similar jobs is shown in Fig. 3. A holder carries a hardened steel roller, which is brought to bear against the work with considerable pressure in the same manner as a knurling tool. The finish is rolled on.

A good method for setting the lathe accurately for turning a taper, when it is not equipped with a taper attachment, is

(Continued on page 132)



RMA



## Radio Music for the Critical

Music lovers especially delight in Rauland-Lyric. Used in all audio amplifying stages of a radio receiver, it reproduces with fidelity those elusive refinements of tone quality which, to the trained ear, mean artistic excellence.

Rauland-Lyric is a laboratory-grade audio transformer designed especially for music lovers. The price is nine dollars. Descriptive circular with amplification curve will be mailed on request. All American Radio Corporation, 2668 Coyne St., Chicago.

**Rauland-Lyric**  
ALL-AMERICAN  
TRANSFORMER

The Choice of Noted Music Critics





## MACHINE SHOP HANDBOOK

A wonderful book for machinists, toolmakers and shop men

335 Pages—282 Illustrations

THIS I. C. S. MACHINE SHOP HANDBOOK is a wonderful bargain at \$1. Contains more common sense, practical information than any other book of its kind ever published. Pocket size. 335 pages. 282 illustrations. A book that you will find invaluable in your daily work. Will help you get a better job and a bigger salary.

Price only  
**\$1**

### Contents

Drift tables, measurement, trigonometry, properties of materials, drilling, reaming, tapping and threading, lathe work, threads and thread cutting, measuring and testing, milling-machine work, grinding, helices and spirals, key work, gearing, planer work, shaper work, slotter work, broaching, grinding and polishing and lapping, jigs and fixtures, punch and press work, die casting, gages, gauges and various instruments, lubricants, temperature indicators, metals, heat treatment, chilled iron, welding and brazing and soldering, coating and protecting, filing, stock estimating, chipping, riveting, pipe bending, laying out work, blue prints, bolting, pulleys and shafting, knots and blocks, springs and miscellaneous shop hints.

Just mail this advertisement with a dollar bill and your name and address, and this 335-page I. C. S. MACHINE SHOP HANDBOOK or any of the other I. C. S. Handbooks that you want will come to you by return mail. Money back if not satisfied.

### INTERNATIONAL CORRESPONDENCE IN BOOKS

I enclose \$1 for which you will mail me the Handbook marked X at \$1 each. It is understood that if I am not satisfied I may return any or all of them within five days and get my money back.

☐ MACHINE SHOP HANDBOOK  
☐ Automobile Handbook  
☐ Clockwork Handbook  
☐ Chemistry Handbook  
☐ Electrical Handbook  
☐ Traffic Handbook  
☐ Building Trades Handbook  
☐ Radio Handbook  
☐ Mathematics Handbook  
☐ History Handbook  
☐ Geography Handbook  
☐ Science Handbook  
☐ Literature Handbook  
☐ Art Handbook  
☐ Music Handbook  
☐ Sports Handbook  
☐ Miscellaneous Handbook

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_

**RADIO ENCYCLOPEDIA**  
**FREE!**  
NORWALK RADIO CORP.  
Dept. H. C. 64 READE ST. NEW YORK

**100% MONEY CHARGING**  
Start a steady making business of your own that brings \$100 to \$200 clear monthly profits. No experience needed to operate 111 One Day Money Charging Units. \$25 each brings complete 999 Dials. Easy terms, money back guarantee. Write for free booklet, No. 44.  
HUBBARD BROS. CO.,  
Box P. C. Troy, Ohio  
CABLE 150 R. 1300

## Lathe Shop Methods

### Lathe Shortcuts that Save a Machinist's Time

(Continued from page 111)

suggested in Fig. 4. Two spots, A and B, are turned on the piece. A corresponds to the diameter of the large end of taper and should be just the right distance from the shoulder to the end of taper. B represents the diameter at the small end. The angle of the taper is set parallel with the line of tool travel by moving the tailstock until both spots are exactly equal distances from the point of the tool. This distance may be tested with an inside caliper, as shown. If the measuring is done carefully, there will be no doubt about the accuracy of the taper and very little, if any, filing will be required.

Winding springs on a lathe is an awkward job for some machinists. It does not need to be so if the method illustrated in Fig. 5 is followed. The wire is passed through a short piece of brass or copper tubing and the end is gripped under one chuck jaw. Insert a tool or short steel block in the toolpost between the screw and the tube and press the tube down flat, just tightly enough to allow the wire to pull through without breaking. Get the lathe for the right pitch and proceed to wind the spring with the slow back gear speed.

THE mandrel in Fig. 6 will find many uses in any machine-shop. It is a time-saver for turning bushings, pulleys, gears, or any cylindrical shapes within its capacity. It is especially useful for a job where the hole is over size and will not fit a standard mandrel, as well as for turning a job having a cored hole that is not to be bored out. The movable cone should be a nice sliding fit and the nut should have a right-hand thread.

Figure 7 shows an effective way to drive a job on a mandrel when there is a heavy overhang that perhaps would cause the work to slip around on the mandrel, as is frequently the case when turning and facing castings with a small hole.

We seldom think of a lathe doing the work of a punch press, but Fig. 8 suggests how this is possible and practical when the shop is not equipped with a press. The punch and die are constructed along conventional lines and supported in position by the saddle or by cross pieces resting on the ways of the lathe. The punch holder is bolted to a top plate, which comes in contact with an eccentric shaft held on the centers and driven by a dog in the usual way. Each revolution of the spindle gives a stroke to the punch, and the speed is limited only by the ability of the operator to feed the material through the die. The punch and die are assembled as one unit. The fiber washer shown was a job produced by this method.

As there are more ways than one to skin the proverbial cat, so there are more ways than one to produce a spherical surface on a lathe. A novel and interesting method for doing this is indicated in Fig. 9. A piece of drill rod pointed at both ends does the trick. The over-all length is equal to the radius of the circle to be

## TRUSSES BANISHED

### NEW SAFE WAY!

Now you can throw away forever steel chafing leg straps and other heavy makeshift devices. For a well known American scientist has found a new easy way to support ruptures assisted by means of a wonderful little invention weighing less than 1 lb. of an ounce. Not only do you do away with the objectionable pressure and tight strapping, but you eliminate the "coming down" of rupture when running, straining, exercising, sneezing, etc.—which too frequently leads to strangulation. So great has been the success of this wonderful device that it is being offered to ruptured people on an absolute guarantee of instant satisfaction or no cost. Simply drop a postcard or letter requesting free literature to **THE NEW SCIENCE INSTITUTE**, 6211 City Street, Cleveland, Ohio.

## Learn Cartooning

At Home—in Your Spare Time

from the school but has raised so much the number of pupils of my cartooning from \$10 to \$20 and even a week. The cartooning is a hard method of teaching makes original drawing easy to learn. Send for literature the full information and start to learn your ability. Also send for **THE LONDON SCHOOL**, 1111 National Bldg., Cleveland, O.



## DEAFNESS IS MISERY

I have suffered I was deaf and had head aches for 10 years. My wife and I decided to try the hearing aid and it worked. I am now hearing and will do it all day. The aid is very simple and does not cost much. Write for literature and start to learn your ability. Also send for **THE LONDON SCHOOL**, 1111 National Bldg., Cleveland, O.

**MOVIES IN YOUR HOME**  
Our movie box, practical MOVIE MACHINE, sell as low as \$1.75 postpaid and use same size film as big theatres. We also have wonderful films at low prices. Write for literature and start to learn your ability. Also send for **THE LONDON SCHOOL**, 1111 National Bldg., Cleveland, O.

## Clear Your Skin!

Get this skin in quickly cleared of pimples, blackheads, acne eruptions on the face or body. Barbers, hairdressers, beauticians and all of them. Write today for my FREE BOOKLET, "A Clear Skin Book," telling how I cured myself after being afflicted 15 years. **E. A. GORDON**, 1111 National Bldg., Kansas City, Mo.

**Start a Movie Show**  
SMALL CAPITAL STARTS YOU  
No experience needed. No money to start. No risk. No loss. Write for literature and start to learn your ability. Also send for **THE LONDON SCHOOL**, 1111 National Bldg., Cleveland, O.

## ARITHMETIC OF ELECTRICITY

A practical treatise on electrical calculations of all kinds reduced to a series of rules, all of the simplest forms, and involving only ordinary arithmetic. 200 pp. Price, \$1.50.

**POPULAR SCIENCE MONTHLY**  
250 Fourth Avenue NEW YORK

**SELL BY MAIL**  
Mail Order Book, send for our Dollar Making Circular Service. Circulars with your imprint furnished at one-fourth original cost. Make 92% profit on each dollar order. Add our service to your regular line and watch profits grow. PARTICULARS FREE!  
**A. J. BLUM**, 517 E. Jackson, Chicago



**This Book FREE**

144 pages and valuable to those who want dependable household, automobile and shop repairs with big savings.

**SMOOTH-ON  
REPAIR  
BOOK**

**Smooth-On No. 1**

On your car, stops leaks in radiator, bursted water jackets, tank, hose connections and at gaskets without taking down. Keeps bolts, nuts, grease cups and hub caps from dropping off.

In your home, stops leaks in water gas and steam pipes, tanks and pots, roofs, etc.

In the shop, makes any kind of pressure joints, joins wood, metal, glass and concrete to each other and holds on any metal—iron, brass, lead, aluminum. Makes handles, screws and nuts lastingly tight.

Be your own "fixer" and save much money for better things.

To get perfect results, write to us for and use the Smooth-On Repair Book. Free if you mention this magazine. Get Smooth-On No. 1 in 8-oz., 1 lb. or 5 lb. tins at any hardware store.

**SMOOTH-ON MFG. CO.**  
Dept. 141  
514 Connecticut Ave., Jersey City, N.J.

**Better Shop Methods****Lathe Shortcuts that Save a Machinist's Time**

(Continued from page 112)

turned. A center punch mark is made on the side of the cross compound and a similar mark is put on the tailstock in the center and in the same plane as the one on the compound.

The circle first is roughed out as closely as possible to a template. The points of the rod are placed in the punch marks and the carriage held hard against the rod. By using a round nose or any suitable tool, the job then may be finished to a true circle. Engage the cross feed and hold the carriage against the rod while the tool is cutting.

Either concave or convex surfaces may be produced by this method. For a concave surface hold the rod against the tailstock. For convex surfaces put the rod on the opposite side and hold it against the headstock.

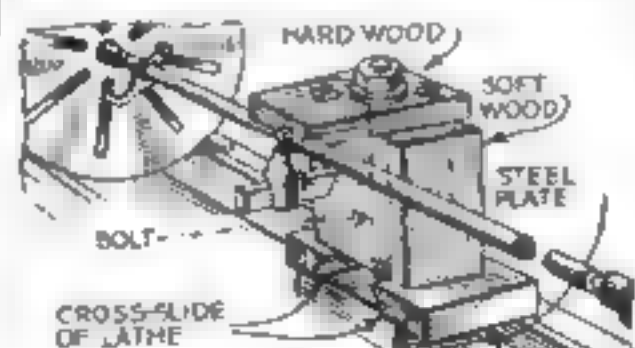
Have you ever tried to true up a commutator and bring the mica down smooth with the surface with a hacksaw blade or other means? A much better and quicker way is by planing it off with the lathe carriage. Grind a tool such as a cutting-off tool from 1/16 to 3/8 in. wide. Give the tool one-quarter turn in the holder, with the cutting edge toward the shoulder, and plane the mica in each groove down smooth by working the carriage back and forth by hand (Fig. 10).

Figure 11 illustrates the use of a box tool in the engine lathe. A tool of this type may be rigged up for many small manufacturing jobs, such as turning, facing, and cutting off small pins, small bushings and similar jobs. Many variations of this tool are possible and with different size guide bushings, many sizes of stock may be handled.

**Cheaply Made Follow-Rest**

THE follow-rest illustrated in an aid in turning shafts of small diameter, especially when other equipment is not available. This simple arrangement will do the work as well as a more expensive special follow-rest.

A wooden block is cut and drilled to receive a machine bolt. The top piece,



A follow-rest made mainly of wood

which bears against the shaft, is of hard wood and is mounted on the block with two screws. The follow-rest is bolted to the carriage with a machine bolt, which passes down into a plate under the ways of the cross slide. When necessary, the bearer can be adjusted for height with packing pieces.—CHARLES KUGLER.

**SAND'S  
LEVELS****Strong and Light**

THESE aluminum levels have unusual strength. The lenses are made of a non-brittle glass that withstands rough usage. You can use a Sand's for overhead work and at arm's length without fatigue.

**Plumb Right**

Window frames and doors are plumb when you use a Sand's. So are walls and foundations. Sand's accuracy is built-in by factory experts.

**Sealed Tight**

The spirit tubes are set and sealed immovably. Sand's accuracy is permanent. The protecting lenses form a double-seal that is dust-proof and moisture proof.

**The Choice of Master Craftsmen**

Sand's is the "buy" word for levels with careful workmen everywhere. Sand's Levels have made good on the job for thirty years.

At Good Hardware Stores  
Everywhere

**SANDS LEVEL & TOOL CO.**

5849 Fischer Ave.,

Detroit, Mich.

**Ask your Radio Dealer to show you these KELLOGG PARTS:**

*Audio Frequency Transformers  
New-Type Low-Loss Variable  
Condensers*

*Radio Frequency Transformers*

Write today for free 5-tube radio frequency circuit diagram

**KELLOGG**

Kellogg Switchboard & Supply Co.  
Chicago, Illinois

**Agents: \$6 Per Day and up**

Selling concentrated, concentrated, concentrated. Always fresh. Put up in 100% pure. You know the name. It's all in the name. Guaranteed under 10 years. All orders. Sold in every house. Used every day. Not sold in stores. Not sold in stores. Not sold in stores.

Men or Women can make good and steady money. You will find this a very easy and a very profitable. Most people are interested in money. Write for territory and sample. Get a list of customers. Get a list of customers. Get a list of customers. Get a list of customers. Get a list of customers.

American Products Co.  
1177 American Bldg. Cincinnati, Ohio

**ZANOL PRODUCTS**

Act Quick Write To-day

**Saw Books FREE**

Saws in the Shop, Saw Sense, "Saws on the Farm."

Write NOW. We will send it FREE. Write NOW.

E. C. ATKINS & CO., Inc.  
Dept. D-20 Indianapolis, Ind.

**Tool Cases**

for Machinists, Carpenters and Tool Makers; none better.

thick series. Quarter oak and metal covered. Ask for booklet.

"Built for Service"

The Pitted Lumber Co., Sycamore, Ohio





SILENT  
MODEL  
NO. 8

**For This  
Bargain**

**HAVE** you a good typewriter in both your home and office? If not, you are running the risk of costly errors, misunderstandings and criticism—no matter how well you write. All business and personal letters and notices should be typewritten. It is the method used by modern men and women, old and young, and anyone can afford a machine on our plan. We will send you one of these wonderful typewriters with no obligation to you whatsoever. Send no money. Just fill out and mail the coupon. This brings full particulars of our Free Trial Plan made by special arrangement with the express company. Take advantage of our Remarkable New Special Low Price Offer which makes it so easy for you to own this handsome full size machine with all the style, finish and modern operating conveniences.

### 10 Days Free Trial!

We want you to give this wonderful typewriter bargain the most thorough test in your own home or office. You cannot imagine the perfection of this beautiful machine until you have seen it and used it. You send no money. When the typewriter arrives, you deposit only \$1 with your local express agent. Test it thoroughly for ten days. Then if you are not satisfied it is the greatest bargain—the very best typewriter you have ever seen—just return it to your express agent and he will promptly return your \$1 to you. If you decide to keep it, you make monthly payments so small you will never miss them—just like rent—and then this wonderful typewriter is yours. No "red tape"—no annoyances—no delay. Five-year written guarantee with every machine.

### A Lifetime Bargain!

We are giving you the lowest price ever made on this wonderful machine—like a new model—up-to-date just like the new, absolutely highest quality rebuilt, perfect adjustment and fully guaranteed. The world famous **SMITH-TYPEWRITER** L. C. Smith has set the standard of quality and long service for over 25 years. It is the easiest running and longest wearing typewriter ever built. The choice of largest and charmingest men all over the world. Over half a million sold. No machine leaves our factory unless it is 100% perfect in every detail. Our prices are so low because we are the world's largest exclusive dealers in L. C. Smith Typewriters. You cannot buy a typewriter at anywhere near our price that will give you as many years of satisfactory service.

### Free to You Now!

A Complete Course of Lessons on touch typewriting. Tests and Water-proof Cover. Complete Operating Instructions; all given with your machine. This is the easiest typewriter to operate and learn. Anyone can use it. Send the coupon now before this offer is withdrawn.

**SMITH TYPEWRITER SALES CORP.,**  
221-240 E. Grand Ave., Chicago

### FREE TRIAL COUPON

Smith Typewriter Sales Corp.,  
221-240 E. Grand Ave., Chicago, U. S. A.  
Send me your New Special Offer. Free Booklet of Valuable Typewriting Information. Your Catalog, and Free Trial Plan with no obligation to me.

Name \_\_\_\_\_

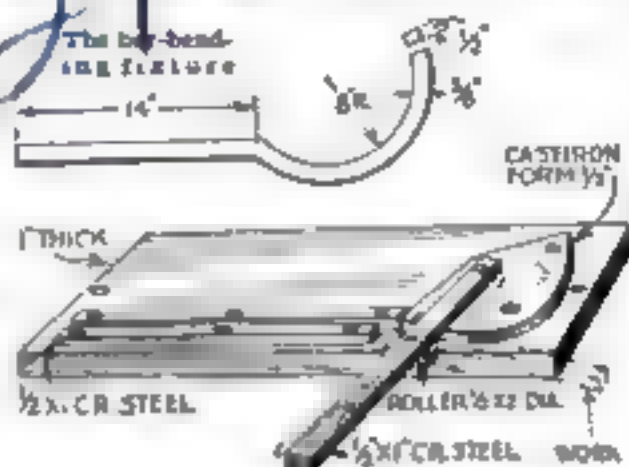
Address \_\_\_\_\_

## Better Shop Methods

### Simple Fixture Aids in Bending Bar Stock Quickly

**T**HE bending fixture shown below was made for shaping a few special parts as cheaply as possible. In the same way many similar jobs may be handled at a minimum expense.

A flat cast-iron plate is placed on one side only. The form is turned to the correct radius and fastened to this plate with three finger-head screws. Two strips of  $\frac{1}{2}$  by 1 in. cold-rolled steel are fastened to the plate adjacent to the form and with a



space between equal to the width of the stock that is to be bent—in this case  $\frac{1}{2}$  in.

The bending lever, which is a piece of  $\frac{1}{2}$  by 1 in. cold-rolled steel, swings on a stud passing through the center of the form. It is provided with a steel roll 2 in. in diameter, set to roll the work up close to the form. The lever stud has no nut on top, so that the lever can be removed for inserting and removing the work.

The work is bent at the point where the bend starts, and the sharp angular bend is made by holding it in the vise. The steel is put between the holding strips on the fixture, the bending lever is put on its stud, and the bend made.—H. L. W.

### Cutting Odd-Sized Core Boxes on a Circular Saw

**T**HE most difficult part of building a core box is in making the circular cut for the core. This often is done with a saw having a corresponding radius, but if the radius of the saw available differs from that of the cut to be made, the problem becomes more complicated, especially if there are no other tools at hand with which to do the work.



This operation can be accomplished, however, by setting the guide on the saw table at an angle and cutting through in the way shown. Several light cuts are taken, each being about the depth of the saw teeth. The saw is raised after each cut until the proper depth has been reached.

The angle to which the saw is set can be determined graphically, although from experience I have found the cut-and-try method quite satisfactory.—C. K.



**FREE!**  
The Greatest Bargain Catalogue published. Chuck full of thousands of Radio Bargains at the lowest prices to be found anywhere in the United States.

Parts, Supplies, Sets, Parts for Sets, Latest Circuits.

Send for this catalogue TO-DAY

We have friends in every City Town and Hamlet. Our reputation is our bond. No red tape. Honest merchandise, goods shipped on approval. No risk—no fraction of money refunded no arguments no money at all. Ask a magazine about us.

**WHOLESALE RADIO SERVICE**  
9 Church St. Dept. A. New York City

## \$450 A MONTH

We want a representative in every county at once to advertise, accept orders, deliver our marvelous new Quick Edge Knife and Shear Sharpener to every home. No talking necessary. Sold upon absolute money back guarantee.

**\$15.00 Per Day**

Sharpen over 100 knives, paring, carving, utility, or other in 10 minutes. A small one for \$1. No money down. Price paid. Large fifty on a fifty orders at 500% mark profits.

Only \$2.00 Selling Price

### NEW INVENTION—JUST OUT

Abolishes dull knives and sharp forever from every home. No charge for training. Business furnishes capital. Profits start first day. No experience required. No dollar. Send no money. Just write for complete particulars—FREE. Ray Carter, of Mass. sold in 3 weeks—priced 25¢. Postal Order, at 10¢, sold in 3 hours—priced 25¢. Act at once. Write Now. Send name and address, and give name of your county.

**QUICKEDGE SHARPENER CO.**  
Jackson, Mich.

### Radio Inventors!

If you have a marketable idea, we have the necessary plant and facilities. Either royalty or outright purchase. Write us at once.

**Box 10-F, Popular Science,**  
**250 Fourth Ave., New York**

## EARN MONEY AT HOME

**I**N your spare time writing show cards. No canvassing or soliciting. Write today within obligation of your name and receive WEST-ANGUS SHOW CARD SERVICE LIMITED. Many satisfied pupils our best reference. 63 Colborne Building. Toronto, Can.

### Inventor's Universal Educator

contains 900 mechanical movements; 40 perpetual motions. Tells how to obtain and sell patents. Suggests new ideas. Explains how to select your attorney and avoid patent sharks. Special price (for a limited time) \$1.00 postpaid. Albert E. Dieterich, 681-A O'Quay Building, Washington, D. C.



# PATENTS

## TRADE MARKS COPYRIGHTS

### PROTECT YOUR INVENTION

ANY NEW article, machine, design or improvement thereof, or any combination of parts or improvements in any known article which increases its efficiency or usefulness, may be patented, if it involves invention.

**FREE**

### If You Have Any New Ideas

which you feel are useful, practical and novel, take prompt action to **protect your rights**. If you have invented any new machine or new combination of parts or improvement, or any new design or process, **SEND DRAWING, MODEL OR DESCRIPTION** of it for information as to procedure to secure protection.



DRAFTING and SPECIFICATION ROOM of CLARENCE A. O'BRIEN, Registered Patent Lawyer, Washington, D. C.

All communications are held in strict confidence. My personal, careful and thorough attention is given to each case. I offer you efficient, reliable and prompt service—based upon practical experience. Highest references.

#### NO CHARGE FOR ABOVE INFORMATION

Write today for free books, "How to Obtain a Patent" and "Invention and Industry" and blank form "Record of Invention."

These books will give you valuable information, and they may save you much time and effort. Send for them now. My practice is devoted exclusively to United States and Foreign Patents and Trade Marks. Write me freely, frankly and with full confidence, it is very probable that I can help you.

Use the Coupon attached, and immediately upon its receipt I shall send you the form Record of Invention to be returned to me with drawing, description or model of your idea; promptly upon receiving your idea I shall write you as to procedure and costs.



**These Books Free**

## CLARENCE A. O'BRIEN

REGISTERED PATENT LAWYER

Member of Bar of Court of Appeals, District of Columbia, United States Court of Claims, Supreme Court of United States, Supreme Court District of Columbia.

### FREE COUPON

CLARENCE A. O'BRIEN, REGISTERED PATENT LAWYER  
8891 Security Savings and Commercial Bank Building  
Directly across Street from U. S. Patent Office, Washington, D. C.

Please send me your free books, "How to Obtain a Patent" and "Invention and Industry" and blank form, "Record of Invention," without any obligation on my part.

Name.....

Address.....

IMPORTANT WRITE OR PRINT NAME CLEARLY.





## "I'm Going to Make More Money!"

"I'm tired working for a small salary. I know I have just as good a head on me as Fred Moore and Bob Roberts, for we used to work side by side. But they've gone far ahead of me."

"Why? Because they saw the value of special training, and I didn't."

"But I know better now. If the International Correspondence Schools can raise the salaries of men like Fred Moore and Bob Roberts, they can raise mine, too!"

"If they have helped others to advance, they can help me. To-day—right now—I'm going to send in this coupon and at least find out what the I. C. S. can do for me."

### INTERNATIONAL CORRESPONDENCE SCHOOLS Box 7847 D, Toronto, Canada

Without cost or obligation on my part, please tell me how I can qualify for the position or in the subject below which I have marked an X.

- | BUSINESS TRAINING COURSES                              |   |
|--|---|
| <input type="checkbox"/> Business Management           | <input type="checkbox"/> Correspondence           |
| <input type="checkbox"/> Industrial Management         | <input type="checkbox"/> Advertising              |
| <input type="checkbox"/> Personal Organization         | <input type="checkbox"/> Master Letters           |
| <input type="checkbox"/> Traffic Management            | <input type="checkbox"/> Business Lettering       |
| <input type="checkbox"/> Business Law                  | <input type="checkbox"/> Penmanship and Typing    |
| <input type="checkbox"/> Banking and Banking Law       | <input type="checkbox"/> Business English         |
| <input type="checkbox"/> Secretarial (including P. A.) | <input type="checkbox"/> Civil Service            |
| <input type="checkbox"/> Night and Day Accounting      | <input type="checkbox"/> Railway Mail Clerk       |
| <input type="checkbox"/> Bookkeeping                   | <input type="checkbox"/> Canadian School Subjects |
| <input type="checkbox"/> Office Secretary              | <input type="checkbox"/> High School Subjects     |
| <input type="checkbox"/> Spanish                       | <input type="checkbox"/> French                   |
| <input type="checkbox"/> Mathematics                   | <input type="checkbox"/> Dictating                |

- | TECHNICAL AND INDUSTRIAL COURSES                  |   |
|---|---|
| <input type="checkbox"/> Electrical Engineering   | <input type="checkbox"/> Architecture             |
| <input type="checkbox"/> Electric Lighting        | <input type="checkbox"/> Architectural Plans      |
| <input type="checkbox"/> Mechanical Engineering   | <input type="checkbox"/> Central Air and Heating  |
| <input type="checkbox"/> Mechanical Drafting      | <input type="checkbox"/> Architectural Drafting   |
| <input type="checkbox"/> Mechanical Shop Practice | <input type="checkbox"/> Concrete Building        |
| <input type="checkbox"/> Railroad Engineering     | <input type="checkbox"/> Structural Engineering   |
| <input type="checkbox"/> Diesel Engine Operation  | <input type="checkbox"/> Chemistry                |
| <input type="checkbox"/> Civil Engineering        | <input type="checkbox"/> Automobile Work          |
| <input type="checkbox"/> Surveying and Mapping    | <input type="checkbox"/> Aircraft Engineering     |
| <input type="checkbox"/> Metallurgy               | <input type="checkbox"/> Agriculture and Forestry |
| <input type="checkbox"/> Ocean Engineering        | <input type="checkbox"/> Mathematics              |

Name \_\_\_\_\_  
Street \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Occupation \_\_\_\_\_

Persons residing in Canada should send this coupon to the International Correspondence Schools, Montreal, Canada.

### "WONDER" Cold Pipe and Tubing Benders Do Not Crush, Flatten or Crimp the Pipe

Hand and Motor Operated  
24 SIZES OF MACHINES

What It Costs to Bend Pipe  
Our Way. Per Bend

|         |        |         |     |
|---------|--------|---------|-----|
| 2" Pipe | 5¢     | 4" Pipe | 15¢ |
| 2" Pipe | 10¢    | 6" Pipe | 60¢ |
| 8" Pipe | \$1.00 |         |     |

Send for Catalogue  
American Pipe Bending Machine Co., 31 Paul St., Boston, Mass.

### Patents—Trade Marks S. T. WALKUP

Registered Patent Attorney  
Counsel for Attorneys

Consulting Mechanical and Electrical Engineer  
Patents and Inventions Appraised

WOOLWORTH BUILDING NEW YORK CITY

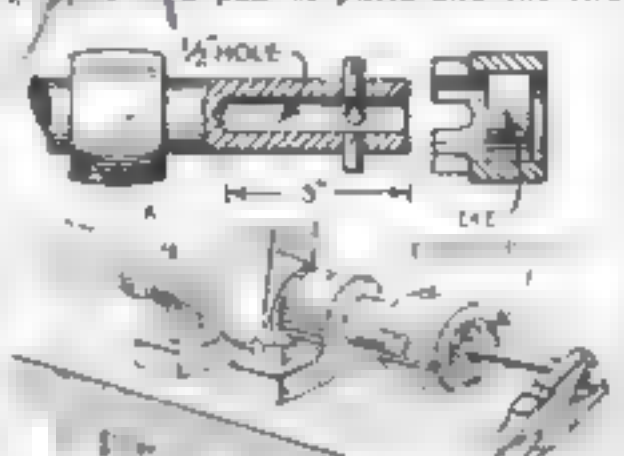
### Better Shop Methods

#### Cheaply Made Bench Machine Threads Small Work Rapidly

A SIMPLE threading machine that saves time in cutting threads on small work is illustrated. With this machine odd jobs of threading can be done more conveniently and quickly than by putting them in the lathe.

Two pillow-block bearings are bolted to the bench to take a shaft, which is fitted with a pulley and drilled at each end for four pins. These pins engage the four projections on a die-holder made of pipe. The speed should be about 250 revolutions a minute.

To thread bolts or rods, the bolt is placed in a pair of pliers and the end



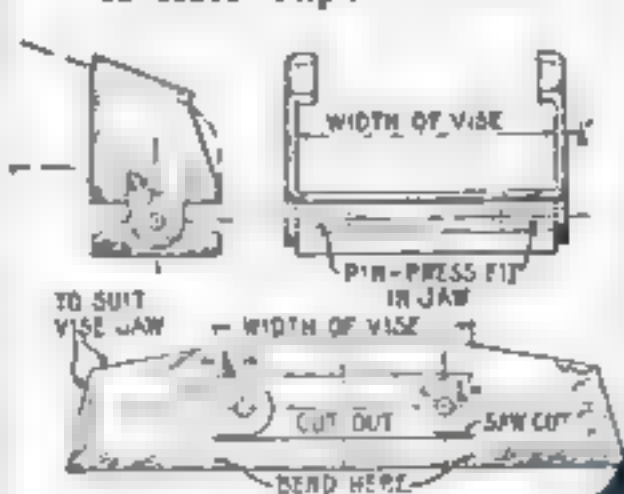
One end of the shaft runs the threading die on, the other turns it off.

pressed into the die as shown. When the desired length has been threaded, the rod or bolt is drawn from the shaft, taking with it the die-holder. This, of course, stops the die-holder from rotating. The shaft never stops.

To run the die off the bolt, it is placed on the left-hand end of the shaft, as shown at A, the rod or bolt being held with the pliers as before.

With a little practice threads may be cut rapidly and accurately. The cost of the machine is small, in this case being only \$1.50 for material and a few hours' work.—H. E. B.

#### Constructing Swivel Vise Jaws to Hold Tapered Work



THE swivel jaw shown in detail above is one that has proved satisfactory for general work. The construction is so simple that the cost is insignificant, and the time it saves and the many uses for which it can be put. This design may be modified to fit a size of any size or style. The jaws are of steel and are made in pairs.—WALTER LYON, Milwaukee, Wis.

## U.S. PATENTS



### DON'T LOSE YOUR RIGHTS TO PATENT PROTECTION

Before disclosing your invention to anyone send for blank form "EVIDENCE OF CONCEPTION" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your invention and establish the same before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the United States and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception," sample, instructions relating to obtaining of patents and schedule of fees sent upon request. Ask for them—a post card will do.

PATENTS AND TRADE MARKS  
**LANCASTER & ALLWINE**  
Registered Patent Attorneys in U. S. and Canada

274 Outway Bldg.  
WASHINGTON, D. C.  
Solicitors at Large "Evidence of Conception."

## PATENTS

### To the Man With an Idea

I offer a most comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts, frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

**RICHARD B. OWEN**  
Patent Lawyer  
6 Owen Building, Washington, D. C.  
41-D, Park Row New York City

## INVENTIONS Commercialized

ON A CASH OR ROYALTY BASIS

For the INVENTOR the MANUFACTURER

In Business 25 Years Complete Facilities References

**ADAM FISHER MFG. CO. 183-D St. Louis, Mo.**

## Mason, Fenwick & Lawrence

Patent and Trade Mark Lawyers

Washington, D. C. New York Chicago

Established over 40 years Write us

Inventions Protected Trade Marks Registered



# PATENTS TRADE-MARKS AND COPYRIGHTS

## OUR OFFER:

### Your first step

Before disclosing an invention the inventor should write for our blank form "RECORD OF INVENTION." This should be signed, witnessed and returned to us together with model or sketch and description of the invention for INSTRUCTIONS.

NO CHARGE FOR THE ABOVE INFORMATION  
**Our Four Books Mailed Free to Inventors**

*Our Illustrated Guide Book*

### HOW TO OBTAIN A PATENT

Full instructions regarding U. S. Patents. Our Methods, Terms, and 100 Mechanical Movements illustrated and described.

### OUR TRADE MARK BOOK

Shows value and necessity of Trade Mark Protection. Information regarding Trade Marks and unfair competition in trade.

### OUR FOREIGN BOOK

We have Direct Agencies in Foreign Countries, and secure Foreign Patents in shortest time and at lowest cost.

### Progress of Invention

Description of World's Most Pressing Problems by Leading Scientists and Inventors

ALL COMMUNICATIONS AND DATA STRICTLY CONFIDENTIAL  
INTERFERENCE AND INFRINGEMENT SUITS PROSECUTED



Private Office, Victor J. Evans, with View of Patent Office Through Window

Highest References Prompt Attention Reasonable Terms  
**VICTOR J. EVANS & CO., Patent Attorneys**

Main Offices: 705 9th Street, N. W., Washington, D. C.  
Gentlemen: Please send me FREE OF CHARGE your books as described above.

**FREE  
COUPON**

Name \_\_\_\_\_  
Address \_\_\_\_\_



New York Office  
Suite 1007 Woolworth Bldg.



Philadelphia, Pa., Office  
Suite 714-715 Liberty Bldg.



Washington, D. C., Office  
Victor Bldg.



Chicago, Ill., Office  
Suite 1114 Tacoma Bldg.



Pittsburgh, Pa., Office  
Suite 514, Empire Bldg.



San Francisco, Cal., Office  
Suite 1018 Hobart Bldg.



# PATENTS

TRADE-MARKS  
DESIGNS  
FOREIGN PATENTS

## MUNN & CO. PATENT ATTORNEYS

*Associated since 1846 with the Scientific American*

683 WOOLWORTH BUILDING  
New York City

322 SCIENTIFIC AMERICAN BLDG.  
Washington, D. C.

411 TOWER BUILDING  
Chicago, Ill.

364 HOBART BUILDING  
San Francisco, Cal.

219 VAN NUYS BUILDING  
Los Angeles, Cal.

Books and Information on Patents  
and Trade Marks By Request.  
Associates in All Foreign Countries.

## The Magic Stuff that Saved Nome

(Continued from page 137)

convert them into vaccines of the first order. These are used where a very quick immunizing response is needed. They shorten greatly the period required for preventive immunization.

Bacterins and aerobacterins are made mostly from several strains of germs of each disease. When a person has pneumonia, for example, it may be one type of this infection out of several possible types, or it may have been caused by a number of mixed strains. The same thing might apply to cases of blood poisoning.

The infections are commonly mixed. Therefore it is vital, at times, that serums contain antibodies effective against a number of mixed strains.

**T**HE bacteria used to produce these products come from typical cases in hospital and private practice all over America. The specimens are examined by bacteriologists for identification, and the various strains or types are selected and cultured.

One of the important developments of immunology was the discovery that susceptibility to various diseases—diphtheria among them—could be told by skin tests made by injecting preparations of disease germs between the layers of the skin. In this way the presence or absence of sufficient natural specific antibodies in the blood could be determined through slight inflammation or lack of it, at the point of inoculation.

Thus experiments were begun to learn why a few children never contracted diphtheria, although exposed. The reason was found in the antibodies in their blood. This led to the Schick test, by which the immune children could be picked out. It led also to the development of the toxin-antitoxin immunization, which makes susceptible children safe from diphtheria.

**D**IPHTHERIA, by the way, is peculiarly a disease of children. Very young infants usually are immune, it being believed that antitoxin from their mothers' blood passes into their bodies before birth. The highest degree of susceptibility lies between the ages of one and two, when only 30 per cent of children are immune. After the age of three the number of children contracting the disease falls off rapidly.

Why, though, should some children be immune and others not? The answer is that repeated exposures to disease, coupled with the strength to throw it off, gradually build up immunity. For this reason city children, constantly exposed to slight infections, are less a prey to diphtheria and similar infectious diseases than are country children. For this reason, young men from the crowded tenements during the war stood up against disease ravages where men from homes in sparsely settled sections went down easily. For this reason, too, an isolated community such as Nome is in particular danger from epidemics of diphtheria, and the danger is heightened

(Continued on page 139)



## Bossert-Built Houses Can Be Erected By 2 Persons Within Few Days' Time

*From Homes to Summer Bungalows  
We Have the Type You Want. No  
Delay or Waste in Erection!*

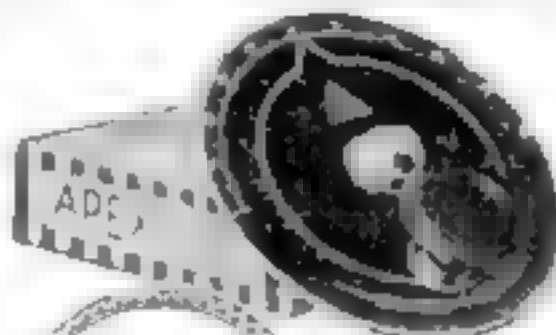
There is a Bossert House for every need. Whether it is a substantially constructed home for all year use or a cozy little bungalow for your summer weeks at the seashore or in the mountains. Bossert has the type that exactly meets with your requirements.

Every Bossert Sectional House is built at our plant by experienced and highly skilled builders. The house is delivered to you either sectional or ready-cut as desired, complete with plans and specifications, millwork, glassboard, when specified, hardware, paint and varnish. Architect's fees, builder's wages, and construction delays are eliminated. Because you deal directly with one of the oldest and largest lumber plants in the East you are guaranteed highest quality and complete satisfaction with lowest prices.

We have a handsomely illustrated catalogue of Bossert houses which we will be glad to send you free upon receipt of your address. Write us TODAY.

Consult Bossert first for: Homes, Summer Bungalows, Club Houses, Garages, Church Buildings, Hospitals and Additions.

**Louis Bossert & Sons, Inc.**  
Largest Lumber Plant in the East  
House Dept. 1310 Grand Street  
BROOKLYN, N. Y.



## MORE DISTANT STATIONS

WITH THE APEX VERNER DIAL

Greater range, bigger volume, finer selectivity, less interference. Lasts forever. The one big advance yet made in tuning. Ratio 12 to 1.

Quickly applied to any shaft.

For sale by all good Radio Dealers.

If unable to obtain from dealer, enclose

\$2.00 for  
Royal Beam  
Finish.

\$2.50 for  
Satin  
Silver  
Finish.

\$3.50 for  
De Luxe  
Gold  
Plated  
Finish.

### The Apex Super Five

is a tuned radio frequency receiver of the highest type. Built into a highly finished walnut cabinet complete with Jones Multiple Battery Cable—all settings highly gold plated. List price \$75.00 complete.

### 7 Tube Microdyne Super-Heterodyne for \$97.50

Receive the parts complete to assemble your set. Cost to cover on an 18 in. loop. Assemble this 7-tube Microdyne Super-Heterodyne on a 7 x 18 in. panel in 3 hours. Parts complete. Price of cabinet, to fit, on application. If your radio dealer cannot supply, send check or money order and name of dealer.

**Apex Electric Mfg. Co.**

1410 W. 53rd Street Dept. 483 Chicago



## The Magic Stuff that Saved Nome

(Continued from page 134)

because medical supplies and medical skill are likely to be lacking.

The latest development with diphtheria antitoxin is in a super-concentrated form, the result of years of experiment to separate the antitoxin substance from the horse-blood serum in which it is produced. This was the sort of antitoxin that was carried into Nome—an explanation of the fact that 300 000 units could be compressed into a package which, with its wrappings, weighed only 20 pounds.

The modern antitoxin not only is less bulky than the serum of former years, but is correspondingly more potent and more easily and quickly administered, without the suffering once forced on the patient.

AMONG outstanding recent developments is the fact that scarlet fever, perhaps the most troublesome of children's diseases, at last seems to have been brought to control and prevention by the discoveries of Drs. George and Gladys Henry Dick, of Chicago, and of former workers.

The Dicks produced experimental scarlet fever in human volunteers through the use of cultures of various strains isolated from scarlet fever cases. After producing this disease, they demonstrated that susceptibility to scarlet fever could be determined by skin inoculation, as in diphtheria.

It is believed, though not positively demonstrated, that scarlet fever is caused by certain specific strains of the streptococcus, the deadly bacterium that causes blood poison of different types.

Seventy-four per cent of the deaths from scarlet fever occur in children under 10, and survivors frequently develop later trouble due directly to this malady.

Again, as in diphtheria, it is probable that the natural immunity from scarlet fever, acquired by many, is a contact immunity, brought about by repeated exposures and mild infections. In a private school, with students from protected homes 85 per cent were found susceptible to scarlet fever, while in a public school in New York City only 22 per cent were susceptible.

The means now are readily available not only for carrying out the Dick test, but for applying the immunizing treatment to those susceptible, and for administering the scarletinal antitoxin to those manifesting symptoms.

THE germ of scarlet fever is thought to be only one strain of the streptococcus bacterium. Other strains of this organism are responsible for serious diseases, including blood poisoning, erysipelas, and childbirth fever. Science has found a way to produce a serum containing antibodies capable of antagonizing or neutralizing a wide variety of these strains, and recent advances have improved the activity or potency of this serum.

Experiments with antistreptococcus (blood poison) serum in smallpox cases

(Continued on page 140)

# W. L. DOUGLAS

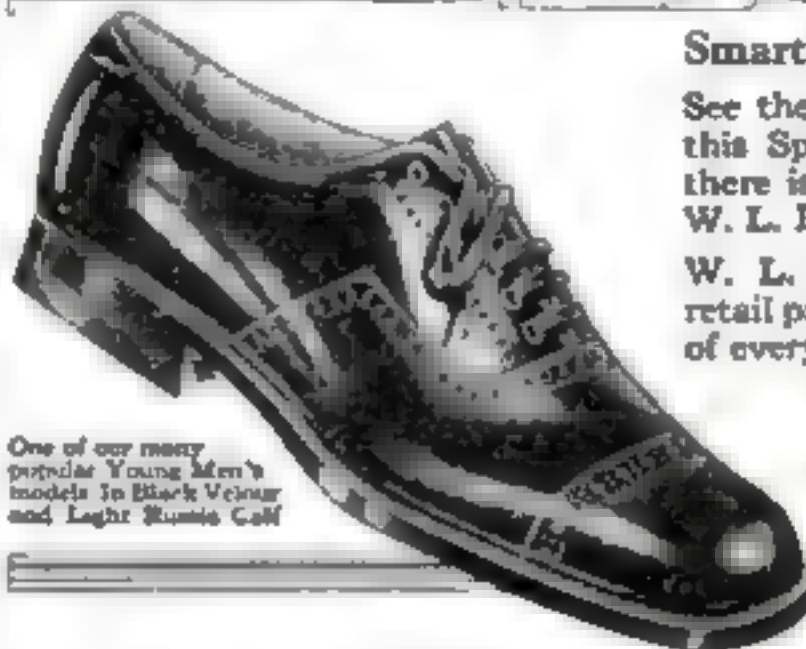
\$5 \$6 \$7 & \$8  
SHOES



Men's  
Shoes at  
Popular Prices



One of  
the most  
stylish  
styles for Women



One of our many  
popular Young Men's  
models in Black Velvet  
and Light Russia Calf

## Smart Styles for Young Men

See the new styles ready for you this Spring and remember that there is sure economy in buying W. L. Douglas Shoes.

W. L. Douglas' name and the retail price is stamped on the sole of every shoe at the factory.

We own and operate 130 Retail Shoe Stores in the principal cities. W. L. Douglas shoes are also sold by over 6000 retail shoe dealers.

W. L. DOUGLAS SHOE CO.  
Brockton, Mass.

## \$25.00 in PRIZES

See top page 8 in front of book for details

### For your home shop!

#### PARKS

Cabinet Shop Special

\$225

with all attachments and motor



HERE'S an all-round woodworker for the small shop. Sturdy, fast and true. The biggest little woodworker ever built. Saw table has 8-in. rip and cross-cut saw, and 4-in. jointer and borer. You can choose from these extra attachments: hand saw; shaper; sander; lathe, and motor. Send for Bulletin C-S and complete Parks catalog.

The Parks Mill Sizing Machine Company  
1547 Kneffton St., Cincinnati, O.  
Cincinnati Factory: 20 Main Street, Del., Del., Del.

# PARKS

WOODWORKING MACHINES



Give  
Cheer to  
the Sick Room  
with

## Cunningham RADIO TUBES

THOSE endless hours that used to drag by so heavily now trip past on dancing feet. The pain the discomfort is forgotten. Over the air come those unseen, lightning-like impulses which your receiving set, equipped with Cunningham Tubes, turns into glorious sound.

Since 1915  
Standard for All Sets

Types C 301A, C 200, C 300, C 11, C 22.  
In the Orange and Blue Cases

Patent Notice: Cunningham Tubes are covered by patents dated 5-18-18, 2-18-17, 12-30-13, 10-23-17, 10-23-17, and others issued and pending.

Containing both 40-page data book fully explaining care and operation of Radio Tubes now available by sending 10c in stamps to San Francisco Office.

*E. J. Cunningham Inc.*

HOME OFFICE  
SAN FRANCISCO CHICAGO NEW YORK



# What Will Rogers



does  
between acts

WHEN he's not amusing folks on the stage of The Follies, Will Rogers has other ways of turning minutes into money.

With his Corona, in his dressing room, he turned out his famous book, "The Illiterate Digest"—the best selling book of humor of the year.

That's the advantage of owning a Corona. You can use it anywhere, any time—make something of the spare moments most people squander.

By the way, have you seen the New Corona Four? It has a full-size standard keyboard, the same as big office machines, yet it is portable.

Corona Four costs only \$40. Easy terms if desired. Look for Corona in your phone book or write Corona Typewriter Co., Inc., 223 Main St., Corvallis, N. Y.



# CORONA

Easy to Play  
Easy to Pay



BESSCHER  
Director Besscher  
Krieger and His  
Orchestra Brass  
Band Records.

True-Tone  
Saxophone

Student of all saxophones, play and one of the most beautiful. This saxophone is a great find for you a quick easy start. In a few weeks you can be playing popular tunes. No teaching necessary. You can take your place in the band or orchestra in a few days. If you so desire. Most popular instrument for dance orchestras, bands, entertainers, church, clubs and school. A Saxophone player is always popular socially and has many opportunities to earn money. Buy Days' trial and easy payments arranged.

Free Saxophone Book

Send for free book and give first lesson sheet; also pictures of famous professionals and orchestras. Just send your name for a copy. Mention in further correspondence in which you may be interested. BUSSCHER BAND INSTRUMENT CO. 1000 N. 1st St. and Orchestra Instruments. THE BUSSCHER CO. - CLARK, MINN.

## The Magic Stuff that Saved Nome

(Continued from page 139)

are reported to have shortened the course of the disease and prevented pitting and secondary infections. In erysipelas, streptococcus pneumonia, streptococcus complications in scarlet fever, and in other infections, this serum has brought marked advances in medicine.

This serum also has been experimented with in the treatment of pernicious anemia. One theory regarding this little understood disease attributes it to auto-intoxication of intestinal origin.

Auto-intoxication, or deterioration of the powers of the blood through the absorption of poisonous matter not properly eliminated is one of the commonest of ailments that make life miserable and ultimately kill. Wrong diet or sedentary habits cause bacteria to infect the intestines, and the toxic substances that result give rise to ailments that are hard to fathom. Medical research in this direction has produced artificially the acidophilus bacillus, which in normal health flourishes in the intestinal tracts and destroys enemy bacteria.

PNEUMONIA is a peril that we all face. The disease, claiming one-tenth of all who fall from infancy to old age, may never be conquered altogether, but extraordinary work has been done in its subjugation. Some years ago a pneumonia serum was produced from the blood of horses inoculated with pneumonia bacteria. This serum, though successful, contained protein matter from the horses' blood that caused harmful reactions in the patient. Also, lacking hospital facilities, the ordinary practitioner was unable to use it.

Recently, however, Dr. Frank W. Hinton succeeded in taking the antibodies out of the serum entirely and suspending them in a clear water solution. This pneumonia antibody has been used with considerable success and has sufficed to cut down somewhat the reactions that ordinarily followed use of the horse serum. There are mixed aerobacteria, too, useful in preventing or treating common colds and bronchitis.

Next to pneumonia and tuberculosis, typhoid fever is the most deadly of diseases, attacking fully half a million persons in the United States every year, of whom every seventh person dies.

YET in the armies of the world typhoid has been wiped out by the discovery of immunization, and it would disappear from civilian life if inoculation were to be practised universally. The average duration of immunity is 30 months. Occasionally one injection of typho-bacteria prevents an attack of typhoid fever. The immunization is harmless to healthy persons, and confers almost absolute immunity.

I should mention, too, the development of a vaccine against hydrophobia, the marvelous work of the lockjaw antitoxin, which has eliminated this disease from the armies of the world as a cause of death, and the experiments with the control of whooping cough and meningitis.

**YOU TOO CAN PLAY THE HAWAIIAN GUITAR**  
JUST AS THE HAWAIIANS DO  
PLAY ALL THE LATEST HITS

**ONLY 4 MOTIONS**

**HAWAIIAN GUITAR**

**PLAY IN HALF HOUR**

**EASY LESSONS**

**FREE GUITAR**

**WRITE AT ONCE**

First Hawaiian Conservatory of Music, Inc.  
Box 100, Honolulu, T. H.

**MONEY**

You too can now earn \$100 to \$250 a Week  
100% profit in your spare time.

**Master Salesman**

I'll make you a Master Salesman. I guarantee to sell 1000 copies of my new book "The Right Way to Sell" in 30 days. No salary. No expense. No risk. You can earn \$100 to \$250 a week. You can learn to sell. Don't think you can't. I'll show you how—guaranteed. My Selling Course includes a best-selling book. Send for your copy now for the great book of your life. "The Right Way to Sell."

Joe F. Ward, Corp. Sales Mgr.  
"The Man Who Makes Money Make"

JAS. F. WARD, General Sales Manager  
Manufacturers Sales Corporation of America  
1014 N. Dearborn St. Chicago, Ill.  
1751 N. Dearborn St. Chicago, Ill.  
Send for your copy now for the great book of your life. "The Right Way to Sell."

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_

**FORDS—Start Easy at Zero**  
Nearly double mileage  
50% More Power

The AIR-FRICTION is the ONLY air-bearing which changes ordinary gasoline into pure oil, super-heated DRY GAS VAPOR which burns up clean, prevents an oil and nearly eliminates power and mileage. Less than an ordinary gasoline engine.

See the deep hole right on cylinder, vibrating and grinding out bearing. Air-friiction, built to show, now on line with Air-Friiction. Ford guaranteed to make 24 miles to gallon. 4000 miles to gallon. 100% Air-Friiction 20 days at our place. Money back if you want it. Agents wanted. Write today.

AIR-FRICTION CARBURETOR COMPANY  
1819 Raymond Building Dayton, Ohio U. S. A.

**Print Your Own**

Write, stationery, business, lab, & printing. 25 up. Paper, Carbon, Ink, & 25 up. Print for others, 10 up. 10. Always ready. Write for the complete information. 1000 copies. THE PRESS CO., P. 22, Portland, Ore.

**LATEST WHOLESALE RADIO CATALOG**

**FREE** Simply send name TODAY for big 48-page catalog of latest radio goods at Wholesale. Live dealers and agents wanted.

STANLEY BROS CO., 100 East 13th, Kansas City, Mo.



## Why the Eclipse Was Late

(Continued from page 139)

already it is beginning to change from the graceful, symmetrical form it holds at the maximum sunspot period to the shorter, brighter form that marks the minimum period.

"Also, photographs made with a camera of 17-inch focal length showed the corona to extend 2,000,000 miles into space. Our largest camera, the focal length of which was 62.5 feet, did not show this amazingly great extension of the corona rays for the reason that its lens was not fast enough to record the exceedingly rapid passage of light through this enormous distance.

"WITH the large camera, however, we obtained images of the moon 7 1/4 inches in diameter, which is on a scale large enough to work out the details of the structure of the corona. This is the principal topic of inquiry at all eclipses, of course, for the corona—the fiery halo of the sun—is seen only at such times.

"Photographs made with cameras of various focal lengths will enable us to determine the laws of distribution of the materials making up the corona.

"We used also two interferometers to determine the distribution of the gases in the corona and also the motion of the gases, our chief hope being to determine whether the corona rotates with the sun in much the same way as our atmosphere rotates with the earth.

"We employed a small spectrograph to find out the relative brightness of the various gases in the corona, and two large spectroscopes in an endeavor to determine what is the distribution of the metallic vapors trained about above the sun.

"Investigation of this sort are of prime interest to the astronomer; of little interest, though, to the layman, to whom an eclipse simply is a splendid spectacle. The spectacular features of an eclipse escape the scientific observer almost entirely. That has been my experience, at any rate.

"AT THE recent eclipse, for example, the amount of spare time I had during the two minutes of totality was exactly 15 seconds. During the rest of the time I was exposing photographic plates, or making ready for the next exposure. Some day, though, I may get an opportunity really to see an eclipse.

"As in other expeditions, we set up a camera also to determine accurately the photographic diameter of the moon as a check on the Einstein theory. We know the distance of the moon from the earth, and we are able to compute its diameter. Photographs obtained with this instrument, which has a focal length of 15 feet, may enable us to ascertain whether the photographic diameter of the moon checks with its computed diameter. Many scientists believe it will not; that the photographic diameter is larger. If they are right, it will show that some force other than that assumed by the Einstein theory is the cause of the deflection of the light of the stars that are nearly on the same line as the sun.

"That the eclipse was late in arriving

(Continued on page 142)

# \$542<sup>00</sup> Earned IN ONE MONTH

## A New Business—Big Business

A Business to Entice Over — The "Ideal" Lawn Mower Sharpener

*A wonderful invention that sharpens lawn mowers scientifically—quickly—perfectly—does the work as nothing else can.*

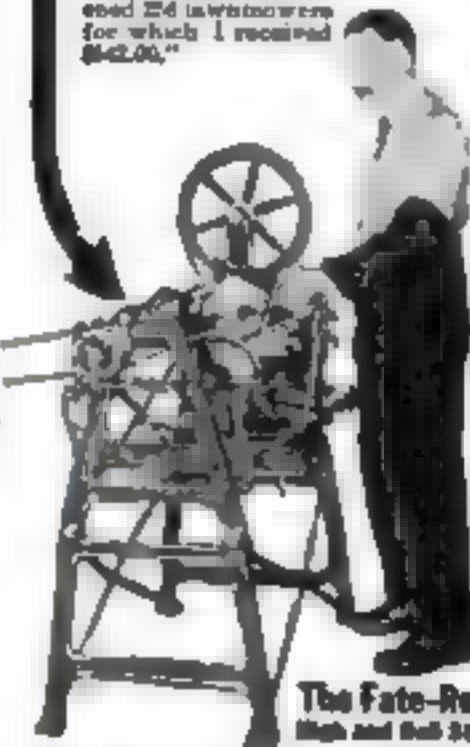
**FRED C. MILKERT OF ROSELLE, ILL., WRITES:** "The Ideal Lawn Mower Sharpener put me in business, starting in the basement of my home and turning me now for the third time to move into bigger quarters. Today the dream of my life—a shop of my own—is realized. With one machine like yours and a little hustle any man can have a business of his own and be independent."

**B. H. NOAKES, MILFORD, OHIO, WRITES:** "Several years ago I started sharpening mowers in a 10 x 10 shed. Today I own a store of my own on Main Ave., No. 212, valued at \$8,000.00. The 'Ideal' Grinder did it all."

**FRED MILKERT, Roselle, Ill., writes:** "Last June I sharpened 24 lawn mowers for which I received \$42.00."

**W. F. KENDY, BUFFALO, N. Y., writes:** "I sharpened 54 lawn mowers last season, and the receipts were nearly \$100.00 which is not bad for a side line."

**ZENG BRANDON, MIDDLETOWN, OHIO, writes:** "I made \$600.70 in 25 days with my 'Ideal.' Have made as high as \$38.70 in one week."



**You Start Now** No town too small. Lawn mowers are dull—owners don't know where to get them sharpened. Mowing the lawn dreaded because of dull or improperly sharpened mower. Lawn mowing beautiful, invigorating and pleasant when mower is "Ideally" sharpened. You do the work scientifically—you are in big demand.

**Lawn Mowers Sharpened to Razor Edge—** People glad—owners delight in mowing lawn with mower sharpened on an "Ideal." Mower runs light—click-click-click and the grass is cut. Build permanent business for yourself. Start now!

## WRITE TODAY

**Free**—Detailed illustrated catalog and booklet "Let George Say It." Write today.

**USE THIS—MAIL IT TODAY**  
The Fate-Rest-Heath Company  
High and Bell Sts., Plymouth, O.  
Please mail at once free illustrated catalog and booklet "Let George Say It."

Name \_\_\_\_\_  
Address \_\_\_\_\_

The Fate-Rest-Heath Co.  
High and Bell Sts., Plymouth, O.

## A TEST EVERY MAN PAST 40 SHOULD MAKE

Medical authorities agree that 65% of all men past middle age (many in their thirties) are afflicted with a disorder of the prostate gland. A sore, aching leg and back, frequent urinating, aching joints are some of the signs—and now a member of the American Association for the Advancement of Science has written a remarkably correct and fine book that tells of other symptoms and just what they mean. No longer should a man approaching or past the prime of life be content to regard these points as mere annoyances, inevitable signs of a "growing old." Already more than 10,000 men have found the amazing relief described in "Growth of the Youthful Health and Vigor" and to rest on the prostate gland to its proper function. Send immediately for this book. It is a real, no-hype request to the Electro-Thermal Company, 4044 Marsh Street, St. Louis, Mo. The company that a doctor butting this book for the author, it will be sent to you absolutely free without obligation. Send your name and address. But don't delay, for the copy of this book is limited. Western Office, Dept. 407, 711 Van Nuys Bldg., Los Angeles, Calif.

## AMBASSADOR Low Loss Products



**Master Tuning Coil**  
Perfectly Balanced Head Phone  
Low Loss Condenser

High grade standard radio products that will improve the efficiency of your set and add to the pleasure of the user. Ambassador Low Loss Products have been tested by the most famous radio engineers and found to be the best. Buy them, and you will know them.



At all good dealers  
Write for FREE cross diagrams in which Ambassador products can be used.  
**AMBASSADOR SALES COMPANY**  
106 Greenwich St., New York  
324 W. Madison St., Chicago

## Why BOSTON?

Because it has exclusive features

ALL Rubber Oblong Button, holds stockings taut for trim ankles.

Hook and Eye Cast-off for convenience.

Slide Adjustment for fit and comfort.

No metal parts on face of pad no wrinkles.

The pad without a pucker.

GEORGE FROST COMPANY Makers, BOSTON

HOW DID YOUR GARTERS LOOK THIS MORNING?















## DON'T GAMBLE

in building your set by using inferior parts. You chance the loss of considerable time, money, and patience if the results aren't satisfactory. Be certain! Use only Amasco parts. Made by men who really know their business, they lead the field in all around performance.

AMSCO Parts necessary for those who construct their own include the Low Loss Condenser, a laboratory instrument designed for perfection in set building. Also the Amasco Rheostat, for perfect filament control with all types of tubes and the Amasco Tube Socket with genuine Bakelite Base suitable for pencil or table mounting.

At dealers everywhere. Free literature on request  
AMSCO PRODUCTS, Inc., Bronx and Lafayette Sts., New York

### ADDING MACHINES

**1/3 PRICE**

**SOLD ON INSTALLMENTS**

RELIABLE ADDING MACHINE CORP.  
266 W. Washington Street  
CHICAGO, ILL.

## You Can Play a Hohner Harmonica!

**This FREE Instruction Book Will Teach You How**


Millions of happy people of all ages are now playing Hohner Harmonicas for entertainment, education and popularity. Anyone can quickly learn to play a Hohner with the aid of the Free Instruction Book.

This interesting and instructive book contains a series of easy lessons, charts and pictures which will enable you to quickly master the harmonica and play operatic, classical and jazz selections.

Even though you have had no previous musical training, you can learn to play a Hohner Harmonica. And when you do learn, you will have mastered the first principles of a musical education.

Don't hum or whistle—play it on a Hohner. Ask your dealer for the Free Book today. If he can't supply you, write to M. Hohner, Inc., Dept. 182, New York City.

Leading dealers everywhere sell Hohner Harmonicas—50¢ up.

### GERSTNER CASES

are **GOOD Cases** Mechanists, Technicians and other particular mechanics appreciate their superior quality. Catalog free. Write for it today. N. J. GERSTNER & SONS  
614 Broadway, New York City

### AGENTS

**EARN A GOOD INCOME**

You can sell Premier Knife Sharpeners to housewives, restaurants, stores, etc. Buy out of 10¢ buy 50¢ for 30¢. Write today for attractive offer. PREMIER KNIFE CO. Dept. 9 Detroit, Mich.

**LARGE PROFIT See you**



**World Battery**

**You Save 50%**

World + Volt Storage Batteries are famous for their guaranteed 3-Year Guarantee Bond in Writing.

**SEND NO MONEY**

World Battery Company  
1219 S. Wabash Ave., Dept. 1 Chicago, Ill.

**World Battery Company**  
1219 S. Wabash Ave., Dept. 1 Chicago, Ill.

**World**

## Here Are Correct Answers to Questions on Page 71

1. A little over 27,000 gallons of water for each acre of land. One inch of rain in New York City means that about five and a half billion gallons of water fall on the land covered by the city.

2. Deafness sometimes is due not to any trouble with the nerves of hearing or with the little water-filled sac in which these nerves end, but merely to some ear obstruction that prevents the sound vibrations from reaching this sac. In cases of this kind sound vibrations that enter the teeth may be conducted to the ear-sac through the bones of the head and may be heard in this way.

3. Nowadays the commonest materials for phonograph records are those belonging to a class of manufactured substances sometimes called "artificial resins." The artificial resins are made by chemical processes, mainly out of products of the distillation of coal.

4. A little air dissolves in water, just as salt or sugar does. When a glass of water stands around for a while, some of this air comes out of solution and makes the little bubbles.

5. A few fishes eat seaweeds or other fishes, but most fishes live on the microscopic plants and animals, millions of which are contained in every cubic inch of the surface water of the sea.

6. The full moon is always visible in the daytime when it is above the horizon and not hidden by clouds. Daylight simply makes it less noticeable.

7. They really evaporate just as water does out of an open pan. The chemical from which moth balls are made is one of the substances that can evaporate directly from the solid state without having to pass through a liquid one.

8. Yes, any electric motor can interfere with radio in its neighborhood if the motor is improperly adjusted, so that sparks are produced at its commutator. This causes a clicking in near-by radio sets as the motor turns. It usually can be stopped by overhauling the motor.

9. Probably, but not for a very long time. There is no friction in empty space, as there would be if the earth were revolving in air. The only known thing that is tending to stop the earth is the friction of the tides in the ocean. Probably this really does slow up the earth a very little, but the slowing is so small that science so far has not been able to detect it.

10. Because of the powerful magnets in the dynamo. The little hair-spring of your watch is made of steel. Under the influence of the magnets this spring sometimes gets magnetized. After that it attracts the other steel parts of the watch and will not work properly.

11. It is the unit in which scientists measure the strength of light. Originally it was the strength of the light given out by a standard candle made of a certain kind of wax and of a certain fixed size. A light one candlepower strong is just about visible a mile away on a clear, dark night.

12. Yawning is a stretching and relief of the muscles of the chest and of the breathing apparatus, usually after these muscles have been tense for some time.



## Do Your Eyes Lie?

(Continued from page 38)

able to change the ugly thing and make it seem quite beautiful.

To go back to the house proposition, for instance. You have seen how easy it is to transform an exterior. Suppose we discuss a few things we might do with the interior of a house.

If the builder has placed your mantelpiece too high, you don't have to sit and bewail your fate at having all your rooms look ill-proportioned. You simply place two long, tall vases on the floor, at each end of your mantelpiece. Your imagination draws the connecting lines that seem to draw down the mantelpiece. Or you might place two low, fat vases on the ends of the mantelpiece itself, and one of those broad, fat clocks in the middle.

**I**F YOUR whole room is too high, try placing objects with vivid colors, such as bowls of bright flowers, on the tables, not on the mantelpiece. By such methods you can direct the eyes where you will; you can keep them down if you like.

Or perhaps your room is too low. Then you would run parallel stripes, rather pale in color, from the floor to the ceiling, or you would place a long mirror high on the wall, to reflect the ceiling, and so make your room look lofty. Mirrors always give a feeling of space.

Nowhere is the principle of color harmony—and, for that matter, the principle of line—more important than in dress. I can give you one very simple instance that illustrates them both. Just recently we have discovered that a row of white glass buttons straight down a black dress, from the throat to the hem, can give a look of slenderness. You can suggest a line just by three or four buttons. Or, you will be astonished to find how slim you can make yourself look by wearing dresses cut with the lines sloping inward a little toward the top. That adds an inch or so to your height, too.

Then there are the "distinctive," as the advertisers would say, sleeves and cuffs. If you have short fingers, you'll be surprised to discover how much longer they look when you wear a cuff that droops over the hand. And you'll be equally surprised to discover how much shorter they look than they really are if you wear a number of rings or if you wear a bracelet close to your hand.

**T**HEN there are shoes. If you have normal sized feet, you never have to worry about them. If you haven't, there are all sorts of things that will help you make them look normal. A short vamp, for instance, makes the foot look shorter. With a long vamp, the reverse is true. Laced shoes make the ankle look smaller, just as button shoes make the instep look higher. The black patches on the fancy white sport shoes that run back from the toe along each side, make the whole shoe look smaller by luring the eye away from the true outline.

If you can take an ugly outline and superimpose a beautiful outline, you deceive the eye into seeing only the beauty and being oblivious of the ugly. And that is the esthetic value of optics.

**KENNEDY**  
**RADIODYNE**  
**THERMODYNE**  
**ULTRADYNE**  
**MURDOCK**  
**OSARKA**  
**Glanstahl**  
**MICHIGAN**  
**Deresnadyne**  
**MALOME LEMON**  
**MASTER RADIO**  
**ROYAL**  
**Pathe**  
**HARMONY**  
**AUDIOLA**  
**GLOBE**  
**EAGLE AND**  
**MANY OTHERS**  
**USE THORDARSONS!**  
**FOLLOW THEIR LEAD**



**Super Hot Builders!**  
For the "Best" 45,000 Cycle Super-Heterodyne "RADIO" and other leading publications recommend in highest terms the Thordarson '9 radio transformers. Take no other!

**THORDARSON ELECTRIC MANUFACTURING CO.**  
WORLDWIDE DISTRIBUTION  
CHICAGO, U.S.A.

## Follow the Lead of the Leaders!

Build or replace with Thordarsons

Leading set builders have scientific laboratory apparatus to test, compare and prove the facts about transformers. They continue to use more Thordarsons than all competitive makes combined! Doesn't this answer the amplification question?

Unconditionally Guaranteed  
**THORDARSON**  
*Super*  
**AMPLIFYING TRANSFORMERS**  
Standard on the majority of quality sets

### They Say

(Continued from last month)

#### THEY SAY OF THE ANDREWS DERESNADYNE:

"It secures the finest, one and high selectivity with four tuned volumes and discolors. It brings to the home reproduction of music really comparable to the original. In volume, it breathes as well as gives anything from a quiet tone to a volume that fills a large hall."

(Deresnadyne amplifies with Thordarsons)

#### THEY SAY OF THE RADIODYNE:

"When used with a Radiodyne set, its clear, ringing tones and perfect harmonic quality are reproduced through the loud speaker so clear and distinct that you lose no time."

(Radiodyne amplifies with Thordarsons)

All modern sets now employ Thordarsons. No need to accept substitutes. If dealer is sold out, order them as well mention his name.

**TYPES AND PRICES:** Thordarson "Super" Audio Frequency Transformers are now in two sizes: 2:1 and 4:1. 6:1 and 8:1. Thordarson "Super" Power Amplifying Transformers are 11:1 the pair Thordarson for single Power Amplifying Transformer, 6:1. Write for latest hook up bulletin—free!

## AGENTS 500% PROFIT

GENUINE GOLD LEAF LETTERS

**S** Guaranteed to never tarnish. Any one can put them on doors and office windows. Exceeds gold-leafed lettering for Paul's lack of a small metal sign. R. L. R. made \$9.00 in 10 minutes. Write today for free sample and booklet to general agents.

METALLIC LETTER CO., 434 N. Dear Street, Chicago

**JUST 17c**  
a Day  
Pays for  
this  
Beautiful  
Chair



**Big Catalog FREE**



Home Furnishings  
Pianos or Meters  
Phonographs  
Get our new catalog TO-DAY  
for FREE!

**Larkin Co.**  
Dept. 648 BUFFALO, N. Y.  
Paris, Ill. Chicago, Ill.

## DRAW CARTOONS

**TURN YOUR TALENT INTO MONEY!**  
Cartoonists earn from \$50 to \$500 per week—some even more. Our new book tells you of these and many other ways to become a cartoonist. Send for it today! (See booklet and sample lessons plate explaining all details of course.)

THE NATIONAL SCHOOL OF CARTOONING  
411 Park Building Cleveland, Ohio

**NOW—the Caille 5-Speed Motor in a Light Weight Twin**



Raising and lowering steering handle changes pitch of propeller blades giving variable speeds forward, reverse and neutral, in addition to park and throttle control. (See cut below.) Motor has two cylinders—no vibration. Light weight. Rope starter. Send for our free book on New-boat Motors.

**THE CAILLE PERFECTION MOTOR CO.**  
6340 2nd Boulevard Detroit, Michigan



2 Speeds Forward—Neutral—2 Speeds Reverse  
Note Change in Pitch of Blades



# "They did the work!"



"In September you advertised a one mfd. By Pass Condenser to be attached across the 'B' Battery. As I had three sets of 'B' batteries (detector, amplifier, and power amplifier), I purchased and installed three of them. They did the work magnificently."

THIS message came from one pleased radio fan—from just one radio fan—but the experience of many others is identical. And you, too, will find that a Dubilier By-Pass Condenser in your set will eliminate noises—purify reception—and do the work magnificently!

## Dubilier

CONDENSER AND RADIO CORPORATION

### "Old Town Canoes"



Days that merit  
fond reflection

Days when the lake is crystal clear and the sky is cloudless overhead—these are such days as vacation dreams are made of.

Get an "Old Town." Here is a sturdy canoe of unusual beauty. "Old Towns" are low in price. \$64 up. From dealer or factory.

The 1925 catalog shows all models in snappy colors. It is free. Write for your copy today. Old Town Canoe Co., 1594 Main St., Old Town, Maine, U. S. A.

### play your way ahead

LEADING professionals, like Carroll Martin, famous trombonist of John Jones Orchestra choose Conn instruments because of Conn supremacy in tone, range, mechanism and easy playing qualities. You'll get ahead faster with a Conn, socially or professionally—win new friends, make big money if you choose.



Carroll Martin

### Cultivate Your Musical Bump

Conn is the only maker of every instrument for band: saxophones, trombones, cornets, etc. Write now for Free Book "Success in Music and How to Win It," by Sousa and other artists, and details of Free Trial offer. Mention instrument.

Conn, Inc., 421 Conn Bldg., Elkhart, Ind.



### Your Colds

(Continued from page 41)

the membranes of the nose and throat too dry, which is harmful. Warm, dry air makes us very susceptible to colds. The humidity never should be allowed to drop below 40 per cent and should be above 50 per cent for the most healthful conditions. How you may determine the humidity of a room by means of a hygrometer, or dry-and-wet-bulb thermometer, is shown in the chart on page 41.

If the relative humidity is below 50 per cent, water should be evaporated in the room. If the home is heated with a hot-air furnace, there is a place provided in the furnace for water. This should be kept full. If it does not supply enough moisture, pans of water may be placed on or below the registers. If the home is heated with steam or hot water, pans of water may be placed on the radiators, or containers for water may be placed behind the radiators.

TO THE factor of humidity as a cause for greater susceptibility to colds in congested centers must be added the ease of travel for germs that thrive in the heart of a crowded city. Every streetcar and subway train, every place of assembly, is a favorable stamping ground for the germs of disease. Moving-picture theaters and other indoor amusement establishments enable them to thrive, multiply, and spread their baleful influence. In the country, on the other hand, these agencies of distribution are lacking, and so the rural population is relatively less susceptible to colds.

For similar reasons, indoor workers are likely to suffer more than those whose occupations keep them in the open air. The exception to this rule is found in the case of the outdoor worker who is subjected to severe exposure. The weakening effects of exposure render him especially susceptible to the graver menace of pneumonia. Another factor of importance is the question of home conditions of the outdoor worker. If he spends his nights in close, ill-ventilated, and congested surroundings, the comparative immunity from minor disorders will be nullified.

In the prevention of colds medical authorities say that there are two important factors.

FIRST, the common cold, at least some varieties, is extremely contagious. Prevention lies in avoiding contact with sufferers; for the colds may be transmitted through the common drinking-cups, roller towels, door-knobs, hand-shaking, sneezing, or coughing.

Second, colds are most apt to attack overfed, under-exercised and constipated people, and those who avoid fresh air. To avoid colds, therefore, keep fit; avoid overeating, eat fruit and fresh vegetables and not too much meat or pastry; get outdoor exercise daily. To keep the tone of the body high, and therefore less susceptible to colds, avoid too heavy, soggy flannel underwear or, on the other hand, underwear of weight so light that it allows a chilling of the skin at every

(Continued on page 147)



## Your Colds

(Continued from page 146)

wintery sephyr. Individuals differ in their requirements in this respect, and it is not wise to lay down any rule.

A quick cold-water sponge, especially of the throat and chest, upon rising in the morning, followed by a brisk rub, will stimulate the circulation in the skin and train it to a quick response. Wet feet, lack of sleep, and over-fatigue bring on many a cold, and should be avoided.

The treatment of the common cold after it appears, never is very satisfactory. However, if the cold is detected at a very early stage, you may avoid some misery by a hot full-tub bath, followed immediately by rest in bed in a fairly well ventilated room for 24 hours or more, preferably three days, light diet, and a brisk purge such as may be accomplished by a dose of magnesium sulphate.

These measures may be helpful in shortening the course of the malady and in preventing involvement of the ear and the cavities of the head, which not infrequently occurs, and remember that a cold is not a simple matter. Neglected, it may lead the way to a really serious disease. The services of the family physician should always be sought in severe attacks of this much neglected malady.

## How Quickly Can You Stop Your Car?

(Continued from page 21)

causes each driver had his foot on the accelerator and was forced to shift position. The smallest elapsed time in these instances was 35/100 second. With most of the subjects the time was from four- to six-tenths of a second. With hand brakes the average was even higher.

Applied to various rates of speed, the bureau measurements show astonishing results as to the distances traversed in the half-second interval of mental reaction established as the average. At a speed of 15 miles an hour the progress of the car during this interval is 11 feet, at 20 miles, 15 feet; at 25 miles, 18 feet; at 30 miles, 22 feet, and at 40 miles about 28 feet.

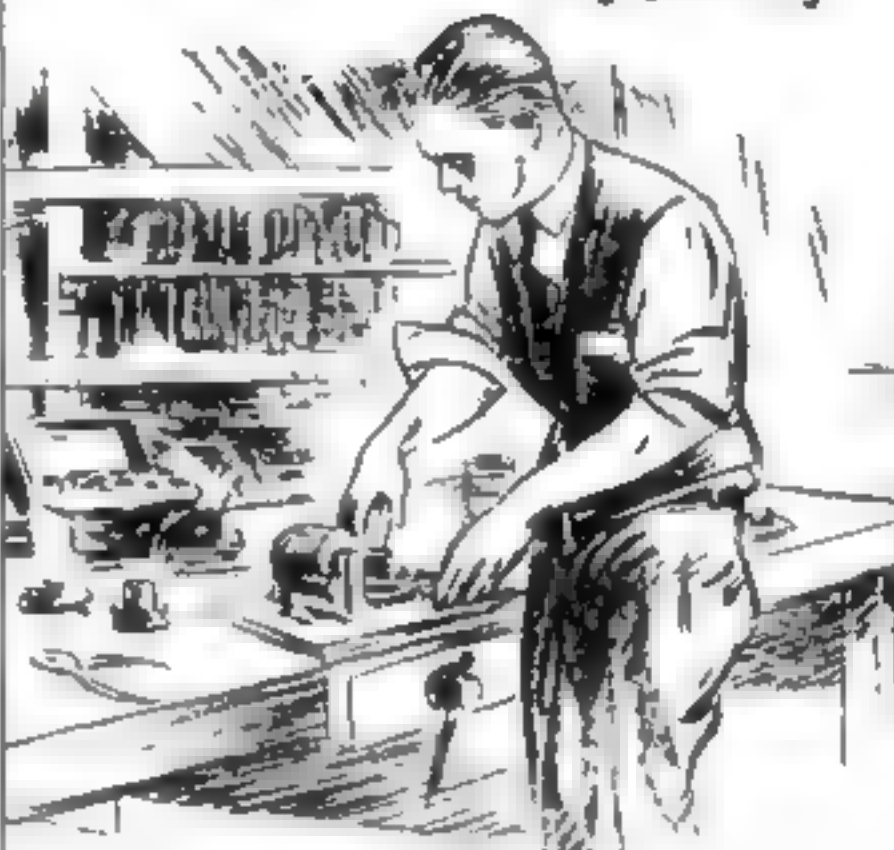
The workings of a driver's mind are influenced by many factors. He may have the habit of considering problems connected with the immediate job of piloting his car, and may become so deeply absorbed that emergencies do not register quickly on his mind. Some psychologists believe drivers may be hypnotized by such factors as glaring headlights. These observers maintain that the brilliant beams induce hypnotic sleep in the driver who is tensed with watching the road ahead; also that many motorists lose mental control in the sharp glare of concentrated lights from an approaching car.

But whatever may be the cause of mental slack in any individual case, Uncle Sam's scientists believe their measurements will be of practical value in awakening drivers to greater alertness and caution, and in setting new standards of driving efficiency. Further, they believe that present brake-testing methods may be revolutionized by apparatus that more closely duplicates emergency conditions.

# Scientists and experimenters choose Eveready Columbias

## EVEREADY COLUMBIA Dry Batteries

—they last longer



## Popular uses include—

gas engine  
ignition  
telephone and  
telegraph  
batteries  
motor boat  
ignition  
heat regulators  
tractor ignition  
starting Ford  
ringing burglar  
alarms  
protecting bank  
vaults  
electric clocks  
calling Pullman  
porters  
firing blazes  
lighting tents and  
outbuildings  
running toys  
radio "A"

FOR home or factory electrical experimental work, Eveready Columbia Dry Batteries are supreme. They give experimenters power of known and dependable quality. Famous scientific and industrial laboratories everywhere use them for delicate work in preference to other sources of electricity. When not in use they rest quietly, renewing their strength for further experiments or tasks of utility and convenience. For every dry battery use, select Eveready Columbia Dry Batteries—they last longer.

Manufactured and guaranteed by

**NATIONAL CARBON COMPANY, INC.**  
New York San Francisco

Canadian National Carbon Co., Limited, Toronto, Ontario

Fabnestock  
spring clip blind-  
ing posts on the  
ignition of no ex-  
tra cost to you.

Ask for  
them by  
name at

electrical  
hardware  
radio  
automobile  
marine supply  
implement and  
general stores

## SEND NO MONEY

2 Genuine Diamonds 4/100 Each

Car Stones, 14 Carat

Solid Gold

\$25

Terms if desired

(5 Net. 10 Pay)

14 kt. White Gold

Top Gold Ring

any Ring or any

other Gold Ring

any 14 kt. Gold

any 14 kt. Gold

any 14 kt. Gold

any 14 kt. Gold

any 14 kt. Gold

any 14 kt. Gold



HOPE RUBY

any 14 kt. Gold

any 14 kt. Gold

any 14 kt. Gold

any 14 kt. Gold

any 14 kt. Gold

No. 8132

any 14 kt. Gold

any 14 kt. Gold

any 14 kt. Gold

any 14 kt. Gold

any 14 kt. Gold

any 14 kt. Gold

## Comfort for tired feet

WORK or pleasure may bring suffering—even torture. But a few drops of Absorbine Jr. quickly soothe, refresh and makes feet fit for another day.

It's a bottle of your druggist.

W. F. FORD, Inc., Springfield, Mass.

**Absorbine Jr.**  
THE ANTISEPTIC LINIMENT



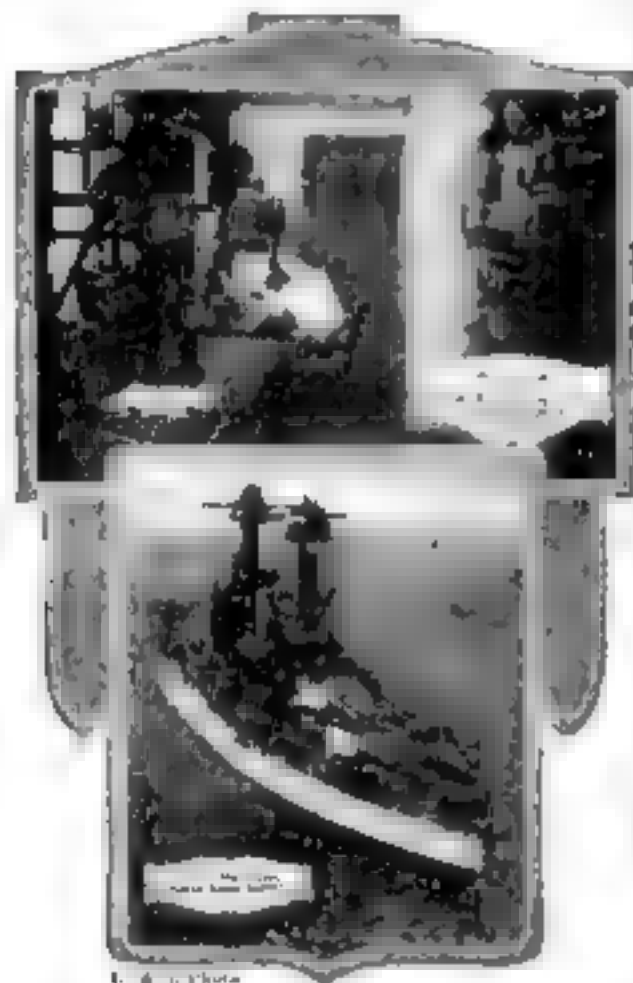








# More Adventures of BURGESS RADIO BATTERIES



The same Burgess Radio 'A', 'B' and 'C' Batteries which are today faithfully serving the nation's armed forces on land and sea and in the air, and used by leading radio broadcasting stations, experienced radio and amateurs, are sold in your own community by your own dealer for your own receiving set.

When you replace your old batteries, ask your dealer for Burgess. Insist upon this brand of laboratory products—you will receive the same measure of satisfactory service that has won the confidence of the radio public.

**"Ask Any Radio Engineer"**

## BURGESS BATTERY COMPANY

Exclusively DRY BATTERIES Manufacturers  
Flashlight • Radio • Ignition • Telephone  
General Sales Office: Harris Trust Bldg., Chicago  
Laboratories and Works: Madison, Wis.

In Canada  
Nagata & Co. Ltd.  
Winnipeg



## A Radio-Frequency Amplifier

(Continued from page 149)

placed farther away from the secondary and tuned either by means of taps or a separate variable condenser.

The secondary circuit consists of a coil connected with the grid and filament of the detector tube and tuned by means of a variable condenser or a variometer.

The third circuit is a coil connected between the plate terminal of the detector tube and the plus-B binding post of the set. In some receivers this coil is ar-

have a choke that will kill the signal strength.

Coil X should consist of about four turns of wire. Any size will do—bell wire is particularly recommended because the insulation is heavy enough to allow the wire to be wound on the tuning coil without fear of short circuits.

One end of coil X is connected with the binding post that was formerly used for connecting the antenna, and this binding

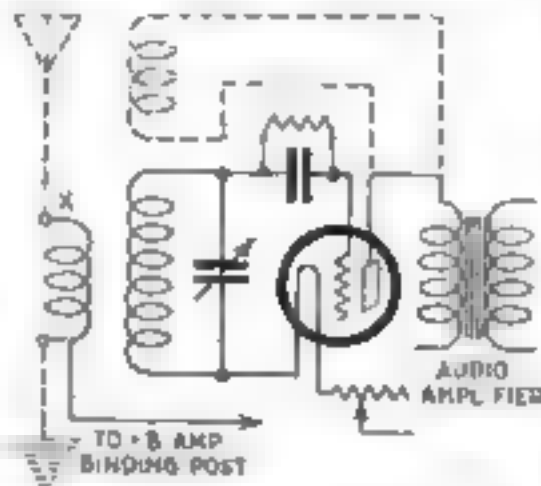


Fig. 8—How to hook the radio-frequency amplifier to a regenerative receiver using aperiodic primary. Four turns of the primary can be used as coil X. The antenna binding post should be connected with binding post 6 of the radio-frequency amplifier instead of antenna.

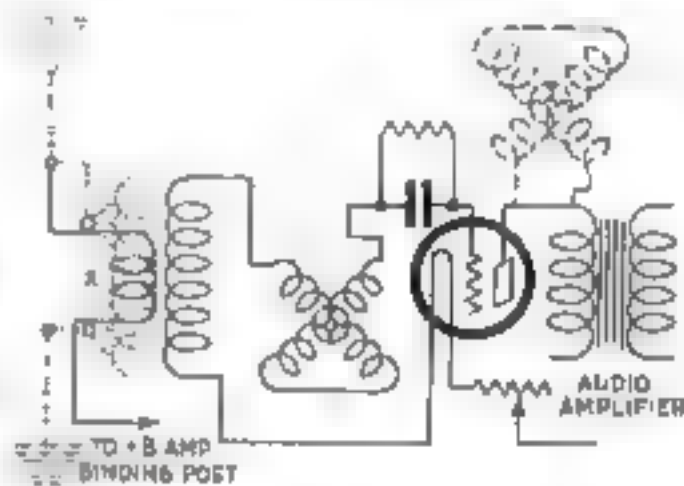


Fig. 9—How to hook the amplifier to a regenerative receiver using variocoupler and two variometers. If your variocoupler has enough taps so that you can get down to four turns in the primary connect as in Fig. 8. Otherwise wind coil X on top of the old primary winding, which should be disconnected entirely from the new circuit.

anged so that it can be rotated close to the secondary coil. This is known as tickler feed-back. In other sets a variometer is used to obtain feed-back by tuning the plate circuit.

So-called single-circuit sets are those in which the secondary coil is also used as the primary.

In order to hook up this radio-frequency-amplifier unit to your present receiver, you must first convert your set into a simple detector circuit and then place coil X, shown above dotted lines in Fig. 2, close to the secondary circuit of your receiver. How to do this is shown in Figs. 8, 9, and 10. The foregoing discussion of the principles on which the regenerative receiver operates is included only so that you may be able to figure out how to make the hook-up if your receiver is outwardly somewhat different from the ordinary types.

IT IS assumed that your receiver already includes one or two stages of audio-frequency amplification, for most radio fans will not be interested in adding radio-frequency amplification unless they already have a stage or two of audio amplification to bring the signals they receive up to loudspeaker strength.

Figure 7 shows the changes to be made in a so-called single-circuit receiver in order to add the radio-frequency amplifier. The coil X of Fig. 2 is here shown wound around the detector tuning coil after the antenna and ground have been removed and the tickler coil (the rotating coil) has been removed from the circuit. Be sure to take the tickler coil completely out of the circuit, for if you simply connect a wire across its terminals, you will

post then should be connected with binding post No. 6 in the radio-frequency-amplifier unit. The other end of coil X should be connected with the plus-B amplifier binding post in your set.

FIGURE 8 shows how to combine the radio-frequency amplifier with an aperiodic regenerative tuner such, for instance, as was shown in the four-tube receiver described in the February issue. Here, the primary coil of the tuner will do very well as coil X, although it will be well to cut out all but four turns. The other changes consist in connecting the antenna binding post with binding post 6 of the radio-frequency amplifier instead of with the antenna, and then removing the other end of the coil from the ground binding post to the plus-B amplifier binding post in your receiver. Also cut the tickler coil out of the circuit.

Figure 9 indicates the method of connecting the radio-frequency amplifier with a regenerative receiver made up of a variocoupler and two variometers. First disconnect the stationary coil of the variocoupler as shown in Fig. 9, and wind five turns of bell wire on top of the old winding and connect as shown. Then cut the plate variometer out of the circuit entirely.

After the tubes have been placed in the radio-frequency-amplifier unit and the rheostats G and H turned on so that the tubes are burning about as brightly as in the audio stages of your set, all the tuning can be done with the two dials on the radio-frequency-amplifier unit and the one dial of your present set. If you find that the signals are broken up by howls and squeals at just the point where they come in strongest, turn potentiometer I slowly,



This One



Y7K0-RN7-G6S2



## Alternating Light Current as B-Battery Substitute

(Continued from page 74)

can be made of drinking glasses with the plates hung over the sides. This is a poor method, however, as the water evaporates rapidly and a crust will form all over the tops of the glasses.

The level of the borax solution in the jars or glasses should be adjusted so that the aluminum plates will have not more than one square inch exposed to the solution.

After you have constructed the rectifier, connect it with the current supply, as shown in Fig. 2, with a 50- to 100-watt lamp in the socket. Be sure to connect the lead and aluminum plates exactly as shown. If everything is right, the lamp will light almost to full brilliancy and then gradually become dimmer and finally go out altogether.

If the lamp does not go out, it is a sign that something is wrong. If you are sure that there are no short circuits in the construction of the caps, try reducing the level of the solution in the jars. If this has no appreciable effect, the chances are that the aluminum is not sufficiently pure for rectifier use.

After the rectifier is working properly as indicated by the lamp's going out, refer to the table at the bottom of page 75 and note the capacity values of the condensers to be used at  $C_1$ ,  $C_2$ , and  $C_3$ , according to the number of tubes in your radio set.

The primary circuit of an alternating-current bell-ringing transformer can be used for the inductance  $L$ . Such transformers are obtainable in any electrical supply store at a cost of not more than two dollars. Most of the larger stores carry telephone condensers of one- or two-microfarad capacity, suitable for use in this circuit. A variable resistance of the graphite disk type will do very well at  $R$ .

Practically all of the receiving sets made today have the secondary and filament circuits grounded, and since the minus-B-battery terminal is always connected with the filament circuit inside the radio receiver, it will be necessary to place a condenser in series with the ground lead of the receiver. Otherwise the electric-light current will be grounded and the fuses will blow. The value of this insulating condenser is unimportant so long as it is above .002 microfarad. The half-microfarad by-pass condensers are satisfactory for use at this point in the circuit.

The simplest arrangement of the B-battery eliminator is to place the rectifier jars in any convenient corner and mount the parts of the filter circuit on a piece of board fastened to the wall just above the rectifier jars. Do not inclose the jars, for they have a tendency to heat up after several hours of operation, and if they are closed in the temperature of the solution will rise to a point where the jars no longer will act as rectifiers. For this reason it is well also to place a double-pole, single-throw switch in the supply line so that the rectifier can be cut off from the house current when the radio set is not in use. If the vent hole is small, the rectifier should give from six to eight months' service without attention.



# Sensitivity

With the extreme sensitivity of the bloodhound's snout, the Model L-2 Ultradyne detects the faintest broadcast signals—signals that are "dead" to other receivers—regenerates and makes them audible on the loud speaker.



## You Can Build the ULTRADYNE MODEL L-2 With this Book

**BUILD** this famous receiver yourself and save money. This book, "How to Build and Operate Ultradyne Model L-2," by R. E. Lacault, E. E., A. M. I. R. E., originator of the Ultradyne, makes it easy for anyone to build this remarkable receiver.

The Ultradyne book explains the "Modulation System" of radio reception and a special adaption of regeneration, as used exclusively in the Model L-2 Ultradyne. This is the latest development of R. E. Lacault, Chief Engineer of this Company and formerly Radio Research Engineer with the French Signal Corps Research Laboratories.

This exclusive feature makes the Ultradyne the most sensitive set known—capable of detecting the faintest broadcast signals, making them audible on the loud speaker. Also the most selective receiver known—regardless of close similarity in wavelength, the Ultradyne selects any station within range, brings in greater distance, clearly, distinctly, faithfully, on the loud speaker.

The regular advertised price of the Ultradyne book is 50c. This 25c Coupon is a special offer only to introduce the Ultradyne Circuit to readers of Popular Science.

25¢

### This Coupon is Worth 25¢

PHENIX RADIO CORPORATION,  
5-7-9 BEEKMAN ST., NEW YORK CITY

Gentlemen: Enclosed find 25c in stamps, together with coupon valued at 25c, for which please send me your popular priced Book of Instructions on "How to Build and Operate Ultradyne Model L-2."

Name

Address

25¢

25¢
25¢



Standard Price 50c



# Making the New Bradleydenser



The brass stator plates are soldered to notched spacer bars that maintain perfect alignment.



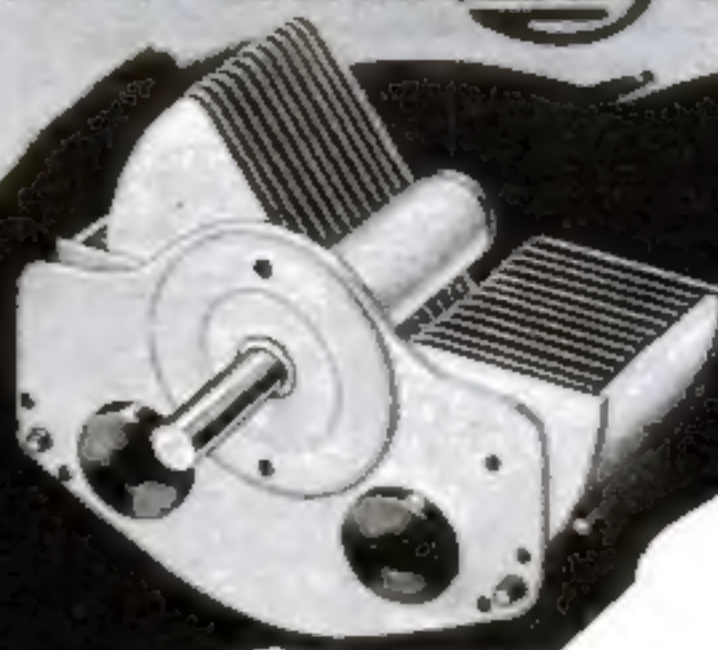
Plates, spacer bars and end plates are all soldered into a solid unit.



The bearing stud, attached to the rotor mounting plate, supports the rotor. See illustration at bottom of this page.



Rotor revolves on a double bearing that is independent of the dial shaft.



**Brass Plates**  
**Low Loss**  
**Low Minimum**

**N**EW and distinctive features are embodied in the design of the Bradleydenser. For instance, the rotor revolves on a long double bearing that preserves rigid alignment and yet eliminates the extra outer end-plate. This reduces the amount of di-electric material and increases the efficiency.

Every joint is soldered. This, combined with the use of brass plates, further increases the operating efficiency. Another feature is the dust cap over the stator plates; it is removable without tools.

The Bradleydenser is made in four sizes: 0.00025 M-f. at \$4.50; 0.00035 M-f. at \$4.75; 0.0005 M-f. at \$5.00; and 0.001 M-f. at \$6.00. Leading radio dealers are showing them, now.

**Allen-Bradley Co.**

Electric Controlling Apparatus

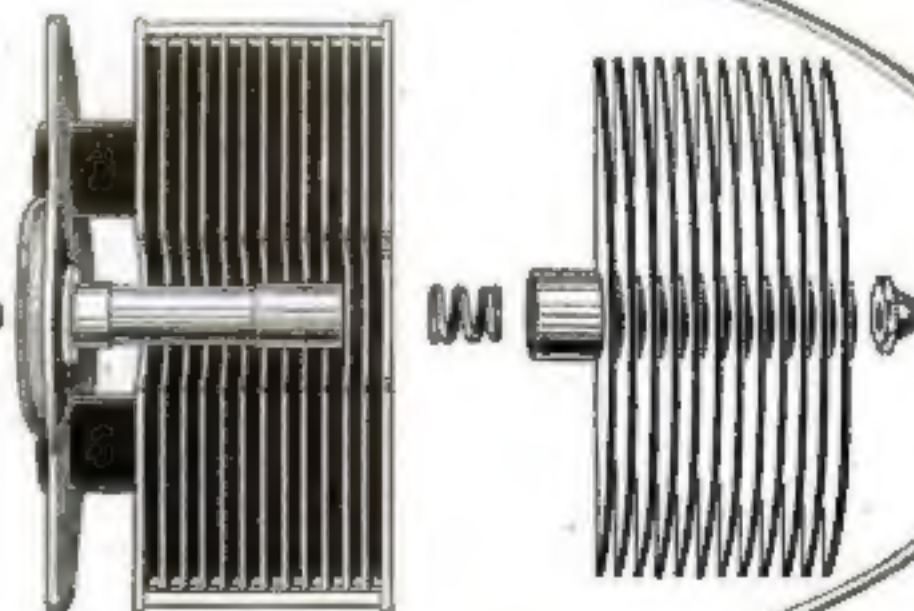
293 Greenfield Avenue

MILWAUKEE, WIS.

Manufacturers of Electric Controlling Apparatus for Over Twenty Years



Disassembled view of the Bradleydenser showing bearing construction, rotor assembly and detachable dial shaft. The shaft does not carry the weight of the rotor.





# Bakelite — Faultless servant of Radio's invisible audience



**BAKELITE** combines properties which make it unique among insulating materials. It has high insulation value and great strength, resists both heat and cold, and is immune to moisture, oil and fumes. Bakelite is unaffected by time and use, and its color and finish are permanent.



Na-ald Dial



Rathbun  
Condenser



Na-ald Tube  
Socket



R. C. A. Tube Base

Radio has banished isolation. It has brought the music of opera and orchestra, the voices of statesmen and teachers into the cabin of the woodman, the home of the farmer and to people everywhere.

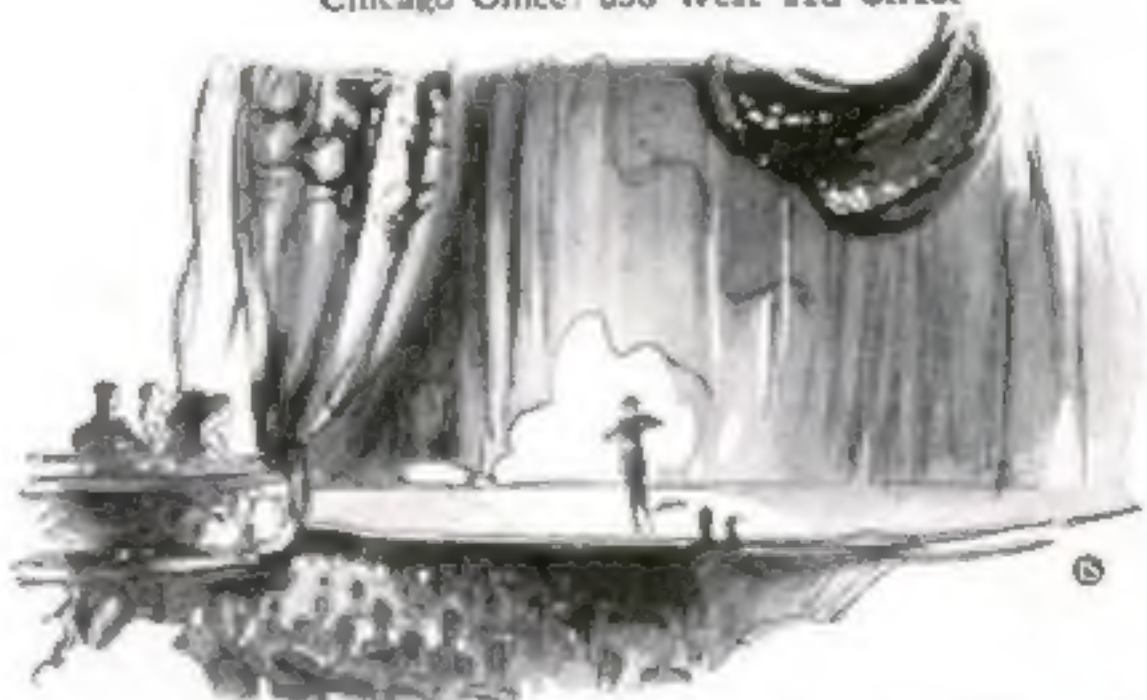
Bakelite is playing a vital part in this universal radio reception. It is used by over ninety-five per cent of the manufacturers of radio sets and parts, for they know that Bakelite insulation can always be depended upon to give superior results in service, in any climate and at any time of year.

Some of the many radio applications of Bakelite are shown in the adjoining column. When buying a radio set or part make sure it is Bakelite insulated, for this is a definite indication of quality.

Write for Booklet 25

## BAKELITE CORPORATION

247 Park Avenue, New York, N. Y.  
Chicago Office: 636 West 22d Street



Bakelite is an exclusive trade mark and can be used only on products made from materials manufactured by the Bakelite Corporation. It is the only material which may bear the Bakelite mark of approval.

# BAKELITE



BAKELITE is the registered trade mark for the phenolic resin products manufactured under patents owned by the Bakelite Corporation.

## THE MATERIAL OF A THOUSAND USES



Shave every day—be comfortable

# COLGATE'S

## for better shaving



What a difference a few years make in fashions! How absurd some of them seem to be, when we look backward!

Would we be willing to adopt the grotesque styles to which our grandfathers submitted? It would take a constitutional amendment, at least, to drive us to such things.

If the compelling purpose back of whiskers that reached from ear to ear, and skirts that left no room for doubt was to eliminate difficulty in telling the sexes apart, its effectiveness can hardly be questioned.

Here a disturbing thought intrudes. Since women have gone in for knickies and bobs and gubernatorial authority, it is conceivable that whiskers may in time have to serve again, as they served originally, to show that men are men.

The horror of such a possibility becomes evident when we see how the well-groomed man of today would look with such whiskers as were fashionable sixty years ago.

A clean shave daily makes a wonderful difference for the better. It has become a business, as well as a social requirement.



### TODAY—

Colgate's Rapid-Shave Cream makes a wonderful lather for easy and comfortable shaving.

It emulsifies the oily coating upon each hair of the beard, permitting moisture to penetrate and soften it at the base, where the razor's work is done.

You will realize as soon as you try it that Colgate's gives a better shave. It leaves the face soothed and velvety.

Thousands of men are turning daily to this new comfort in shaving.



COLGATE & CO.  
Depts. R  
199 Fulton St., New York  
Please send me the trial tube of  
Colgate's Rapid-Shave Cream for  
better shaving. I enclose 4c.

Name \_\_\_\_\_

Address \_\_\_\_\_

Let us send you a trial tube of  
this marvelous cream—enough  
for 12 better shaves than you  
have ever had. Just fill out  
and mail the attached coupon,  
with 4c.

COLGATE & CO.  
Established 1806  
NEW YORK

Truth in advertising implies honesty in manufacture